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ORIGINAL MEMOIRS.

GENERAL INFECTION FOLLOWING ACUTE TONSILLITIS.*

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It has been my fortune to have seen during the past few years a number of instances of profound constitutional and localized infection following acute tonsillitis. These have covered wide areas in the body and have involved various tissues and organs.

The first was that of a gentleman of forty-six years of age, who had a violent tonsillitis, evidently streptococcic and distinctly not diphtheritic in character, which was followed by arthritis of both elbows. This was presumed to be rheumatic and resulted ultimately in complete ankylosis of both joints.

After various methods of treatment had been tried by his physicians in a neighboring city, including repeated etherization and attempts to secure motion in the joints (fourteen attempts in as many weeks), he was finally referred to me for surgical treatment.

An examination by the X-ray showed complete and firm ankylosis of each elbow and almost total destruction of the joints. The elbows were fixed at such an angle that he was helpless, he could not dress nor feed himself and, what annoyed him almost more than anything else, he could not even use his handkerchief.

I resected his left elbow, removing the disorganized joint and being careful to take away an ample amount from the humerus as well as from the ulna.

* Read before the Philadelphia Academy of Surgery, March 4, 1912.

The result from a practical stand-point has been most satisfactory in that he has perfect freedom of motion and a thoroughly serviceable arm.

I declined to resect both elbows at that time, preferring to try what could be accomplished with the left one, leaving to a subsequent occasion operation upon the right.

He has been so much improved in every way and can carry on his business as draughtsman, that nothing further has been attempted.

The second case was that of a small child five years of age, who had an acute tonsillitis, presumably streptococcic, for there was no diphtheria, followed shortly by an epiphysitis of the left femur, and for months she was ill. Finally recovery took place, but with a permanently damaged hip-joint.

The third was that of a lady of twenty-nine years, the mother of three children, who was apparently in perfect health with the exception of a uvula which was somewhat long and annoying. The end of the uvula was clipped off in the office of a throat specialist and by the next day she had an acute tonsillitis followed by very high temperature and evidence of profound constitutional infection. At the end of 48 hours she complained of abdominal pain (she was menstruating at the time) over both ovaries, and this progressed until her symptoms were so urgent that the abdomen was opened by another surgeon. An abscess of the right ovary and tube was discovered with general septic peritonitis.

Death followed in less than a week from the onset of her symptoms and was clearly due to a streptococcic infection with the primary seat of invasion in the tonsil and uvula.

The fourth case was that of a lady of forty, who had an acute tonsillitis directly traceable to an infected telephone through which she had been speaking. Her butler had tonsillitis and used the telephone, then a member of the family developed tonsillitis shortly after speaking through this same telephone, and soon my patient was attacked. All of them were probably streptococcic in origin.

She was a frail and delicate woman and before her throat was entirely well she went to the opera, from which she returned with a chill and very violent headache, and marked increase in her throat discomfort.

A hypodermic injection of morphia was given to her in her left leg by her physician, who used every possible precaution

against contamination by the needle. Soon there was another chill followed by fever and a violent cellular inflammation of the whole of the left leg.

When I saw her some days later, she was in a desperate condition. I opened the leg from the knee to the ankle and gave vent to much pus and broken-down fatty tissue. A smear from this pus showed pure streptococci, but a culture taken at the same time could not be depended upon through an unfortunate mishap in the laboratory.

I have never seen an instance of more profound sepsis; her blood was not red but of a chocolate color, and for a long time I feared she could not possibly live. She recovered only after weeks of illness.

I have seen several other instances of general sepsis following acute tonsillitis, but these four cases will amply illustrate the extreme danger which may result from the very common affection, and which I do not think has been fully appreciated by the general practitioner of medicine.

Enlargement of the cervical lymph-nodes following tonsillar infection is of course very common to all of us, and I have purposely not taken up that phase of the subject. Neither have I considered the infection of the mastoid cells and cerebral complications, of which we all see a few instances.

The masterly article by the late Dr. Frederick A. Packard, the Wesley Carpenter lecturer for 1899, "On Infection Through the Tonsil Especially Connected with Acute Articular Rheumatism," has drawn attention to the importance of this subject, and covered very thoroughly the literature up to that time.

Various observers have shown the relation between angina and rheumatism, and have shown that a large number of staphylococci and streptococci are present in the scrapings from the tongue and mouth, as well as many other forms of bacteria. As the tonsil belongs to the lymphadenoid tissue and is covered by plicated and involuted mucous membrane and is a collection of recesses and glands, it can readily be seen how general infection can follow an acute tonsillitis.

The question of absorption through the tonsils of various materials has been carefully studied, and their power of filter-

ing bacteria is found to be somewhat similar to the lymph-nodes, and to this extent they are of great benefit.

We all know that endocarditis is not an unusual result of tonsillitis.

Packard mentions a case (B. Auché, *Annales de la Polyclinique de Bordeaux*, 1892) of synovitis of the knee and ankle requiring operation, which was followed later by a pleural effusion, and also two cases of peritonitis occurring in the course of tonsillitis as recorded by Groedel and Froelich.

It has been proposed that in acute articular rheumatism (Vosanyi and Lenare, Sixteenth International Congress) the tonsils be immediately and completely removed, and in certain cases where this has been done, it has been followed by a prompt subsidence of joint symptoms and rapid convalescence of the patient.

This is such a radical procedure that it takes our breath away, and only in view of profound constitutional complications can it be considered.

The tonsils as points of entrance for tubercular infection have been well known for a long time. George B. Wood (*Jour. A. M. A.*, May 6, 1905, p. 1425) has demonstrated that in pigs the course of tuberculosis is through the pharyngeal and tonsillar structure, through the glands in the neck into the thorax, and finally to the lung itself. He proves that the tonsillar tissue is more resistive to the action of the tubercle bacilli than the adjacent lymph-glands.

David J. Davis (*Jour. A. M. A.*, July 2, 1910), in an experimental study of the bacteria isolated from the tonsils, found in nearly every instance a pure growth of *Streptococcus pyogenes* from the crypts, and an intravenous injection in rabbits was followed by acute arthritis in nearly every instance.

In a discussion at the last meeting of the American Surgical Association (*Transactions Amer. Surgical Assoc.*, vol. xxix, p. 148) Dr. Maurice H. Richardson mentions a series of cases of constitutional infection all preceded by a simple tonsillitis. Among these were three cases of fatal peritonitis, a phlegmon of the neck, a phlegmon of the fascia lata and all the muscles, a sepsis around the left hip, and total gangrene of the lower extremity.

A THORACIC ANEURISM TREATED WITH GOLD WIRE AND GALVANISM.*

WITH NOTES ON A PREVIOUS CASE AND ON EXPERIMENTAL STUDIES.

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THE writer first learned of the Moore-Corradi operation from Dr. Charles L. Gibson, resulting from which he practised wiring with electrolysis four times in a previous case of aneurism, one of the innominate artery (unpublished), and also, up to the present date, in the aortas of 151 dogs, the object of the experimental work being to glean knowledge from which principles could be defined that might put the operation on a more scientific footing than heretofore. The recovery experiments still lack completion. All of the operations on the dogs were performed under ether anæsthesia. In some preliminary experimental work on this subject as well as in the recovery animals of this series, the writer received valued assistance from Dr. Robert P. Wadhams and Dr. Arthur M. Wright.

The patient here discussed was admitted to Bellevue Hospital in the service of Dr. A. A. Smith, to whom the writer is indebted for the case, and was operated upon in the service of Dr. Bryant, to whom the writer is indebted for the courtesies of his division.

The aneurism developed subsequent to the patient's having been hit on the right hip by the mud-guard of a rapidly moving taxicab and thrown onto the front of his chest and abdomen, 8 months previous to operation. His age was fifty-five; occupation, tailor.

Symptoms before Operation.—Constant pain, cough, shortness of breath on slight exertion. The pain is augmented by coughing

* Case presented before the New York Surgical Society, February 28, 1912. Experimental research through the courtesy of the New York University and Bellevue Hospital Medical College. Special indebtedness to Prof. R. M. Pearce and Prof. Douglas Symmers for facilities lavishly granted by them in the pathological department.

owing to a recent spontaneous fracture across the middle of the sternum.

Physical Examination.—Pulsating expansile tumor protruding a little above the surrounding skin level, at the right edge of the sternum, having eroded through the right second costal cartilage and adjoining portion of the sternum. Crepitus felt with expansile pulsation over middle of sternum. Bruit. A little thrill on exertion.

The plan of operation, based on the animal experimentation and the lessons learned from the previous case, was, to bring as much of the introduced wire as possible into contact with the wall of the sac, and then by means of the current both to injure the areas where the wire touched, and to produce a fibrinous clot along the wire, which at the sites of trauma would form an adhesion with the artery during the electrical séance (Fig. 5). In dogs such adherent fibrin undergoes subsequent organization, binding the wire to the sites of trauma, while that fibrin having no opportunity for adhesion, later breaks away, leaving the wire bare. This carpentering, as it were, into the aneurismal wall of linear areas of organized fibrin, should, like ribs, fortify the structure.

The deposit of the laminated fibrin in aneurisms as a result of the wiring and electrolysis operation is ostensibly a secondary event consequent upon a trauma to the intima, associated with a sluggish blood current, such as could be found in recesses of the aneurism or within a snarl of wire. In the specimen of the innominate aneurism that had been wired with electrolysis, in one situation—a recess overhanging the clavicle—where quite a number of loops of wire were grouped together in relation with the aneurismal wall, a mass of laminated fibrin had been deposited on the latter (Fig. 1, B), and projecting centrally therefrom into the cavity to a height of about two and a half inches was a further deposit of laminated fibrin supported in the meshes of a snarl of wire (Fig. 2). Also one isolated loop of wire (Fig. 1, C) in contact with the opposite wall was associated with a deposit of laminated fibrin about an eighth of an inch thick, which covered an area of about two inches in diameter.

FIG. 1.



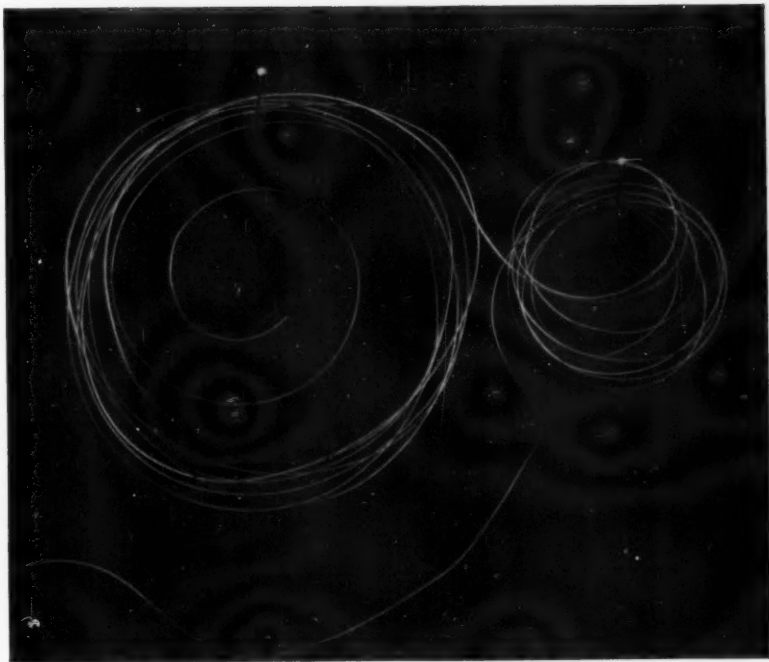
Specimen from the previous case, one of innominate aneurism, which had been wired our times. A portion of the wire (A) had been pulled out by unscientific hands. B, main mass of laminated fibrin which was attached by its base to the bottom of the recess overhanging the clavicle, whence it projected upward about $2\frac{1}{2}$ inches into the cavity of the aneurism supported in the meshes of a snarl of wire (cf. Fig. 2). C, isolated loop of wire imbedded in an area of laminated fibrin about 2 inches in diameter and about $\frac{1}{8}$ inch in thickness. D, site where three loops of wire are bound down to the intima by scar tissue. The projection here is caused by a bony prominence forming the posterior margin of a deep erosion of the clavicle. Many centrally located loops of wire presented themselves free from fibrin and untarnished. E, aneurismal opening. The probe lies in the right carotid artery, which passed across the front of the trachea. The right subclavian artery had the most distal origin of any of the vessels arising from the arch of the aorta, and passed around to the right side behind the trachea.

FIG. 2.



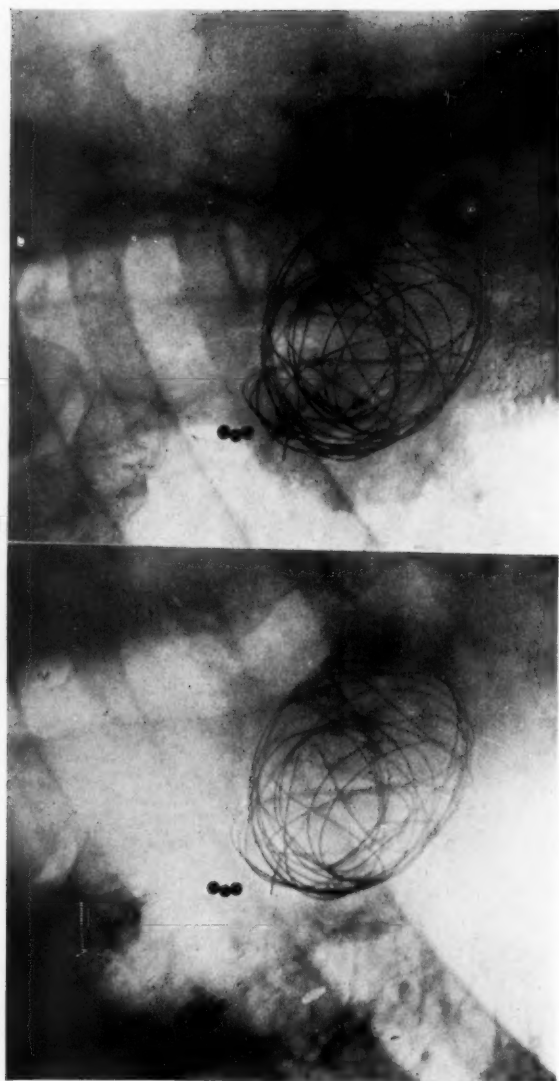
Same specimen as that in Fig. 1, showing appearance of the interior of the aneurism from the reverse side. There is seen the central projection of laminated fibrin supported in a snarl of wire, arising from the basal mass which was deposited in the bottom of the recess of the aneurismal sac overhanging the clavicle. *F*, isolated loop of wire bound down to the intima by scar tissue.

FIG. 3.



No. 28 gold platinum "Clasp" wire coiled for operation (see p. 793). The entering extremity of the wire was spirally shaped so that it could not go astray beyond the limits of the aneurismal cavity nor impinge directly against the sac wall. In order that the coiled loops should not get snarled before using the wire, they were bound together over a short segment of each coil by another piece of wire turned spirally around them, and the spirally shaped extremity was hooked into one of the turns. This fixation of the loops by the binding wire was in this instance done after the photograph had been taken. The spacing between any two of the longer lines on the ruler is $\frac{1}{4}$ inch. The length of the coiled wire was about $10\frac{1}{2}$ feet.

FIG. 4.



Stereoscopic X-ray photograph of the wire *in situ*, taken by Dr. L. T. Le Wald at the Edward N. Gibbs Memorial X-ray Laboratory, 3 months after the operation. If the picture be viewed through a stereoscope (an ordinary hand one is suitable), it will be seen that the loops of wire form essentially a globular skeleton framework which evidently outlines the limits of the sac, thus demonstrating the principle of contact of the wire with the lining of the aneurismal cavity.

FIG. 5.



Shows a microscopic specimen taken from the aorta of a dog which had been killed at the termination of the wiring operation in which the electric current had been used in the strengths successively of 100 ma., 50 ma., 40 ma., 30 ma., each for 15 minutes, which demonstrates the primary agglutination of the fibrinous clot to a site of trauma of the intima. $\times 26$.

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At two other situations, loops of wire were bound firmly to the intima by scar tissue apparently (specimen disarranged by dissection) uncovered by any appreciable deposit of laminated fibrin (Figs. 1, D, and 2, F). The loops of wire examined that lay against the intima buried in the laminated fibrin, were not united to the intima by scar tissue. The sites of binding the wire to the intima by scar tissue without deposit of laminated fibrin seemed to be in regions where the blood current would have been swiftest. Many centrally located loops of wire presented themselves free from fibrin and untarnished. These findings seemed to designate loops of wire in relation with the sac wall as the causative factor in the deposit of the peripheral laminated fibrin, and the rather closely snarled loops of wire projecting centrally therefrom, perhaps through their slowing the blood stream, as the cause of the augmentation of the fibrin deposit in an inward direction. Thus in this case the deposit of laminated fibrin over but a limited area of the sac wall, and the central projection therefrom of a mass of laminated fibrin occupying a comparatively small portion of the sac space, together with the binding of the wires to the intima by scar tissue in two places, was apparently all that had resulted from the operative procedures to give the patient considerable relief from very distressing symptoms. The growth of this aneurism could be but temporarily arrested as a result of operation.

It is of interest that at one of the four wirings practised on this case, when a No. 26 wire coiled in loops $1\frac{1}{8}$ to $1\frac{3}{8}$ inches in diameter was inserted, with repeated twistings so as to snarl it centrally within the aneurismal cavity, no benefit accrued to the patient.

These findings seemed to incline one to believe *that the desideratum to be attained in these cases was to get a good deposit of adherent fibrinous clot resulting from electrolysis, as well as of laminated fibrin, over as large an area as possible of the aneurismal wall, and for effecting such object it seemed proper that the wire should be gotten pretty extensively into contact with the intima so that the electric current could traumatize the latter in lines of rather close association.* The

principle of traumatizing the lining of the aneurismal cavity has seemed to the writer an important one, since, without it, the opportunity for the organization of fibrin is lacking.

The centrally projecting mass of laminated fibrin in the specimen suggests the possibility of producing an internal accretion to fibrin deposited peripherally within an aneurismal cavity, around a suitable nidus of wire.

If the complete obliteration of the aneurismal cavity is not produced unless enough wire be introduced centrally to slow materially the blood current, then the operation conducted with a peripheral arrangement of the wire would be as applicable to fusiform as to sacculated aneurisms.

If that portion of the arch of the aorta proximal to the openings of the carotid arteries is the seat of operation, the danger from cerebral embolism must be considered, since the fibrin primarily deposited on the loops of wire not directly associated with sites of trauma of the sac lining, later breaks free, leaving these portions of the wire bare. Salinger¹ reports a case of cerebral embolism on the third day after wiring a very large aneurism of the first part of the aortic arch. Recovery ensued.

Preparation for Operation: The Wire.—The sort of wire used by the writer is manufactured in size No. 11, and is designated by the manufacturer as gold platinum "Clasp" alloy wire (for assay see p. 802). A piece of the No. 11 wire of about 11½ inches in length, when drawn down to No. 28, will produce a strand about 50 feet long. The special qualifications of this particular kind of wire which make it adaptable to the technic here advocated are (1) its resiliency, which enables it to regain its original shape after passing through a straight needle, and (2) its immunity to any solvent action of the electrolysis.

The wire used on this case, a No. 28 Brown and Sharpe gauge, was, in accordance with the proposition outlined above of bringing as much of the wire as possible into contact with the inner surface of the wall of the sac, specially coiled

¹ Salinger: *Therapeutic Gazette*, July 15, 1903.

(Fig. 3), the first portion in 8 loops of a diameter of about 3 inches and the remainder in 8 loops of a diameter of about $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, the idea being that the larger loops should be of sufficient size to spring against the aneurismal walls, making a good contact with the latter, and that the smaller loops, after introduction, should be snarled by twisting the external end of the wire, and then, by tilting the needle, thrown against the inner surface of the prominent protruding portion of the sac. The attempt to place the latter loops with precision, however, could not be carried out, owing to the fixity of the needle in the tissues through which it passed.

The end of the wire to be introduced was shaped in a spiral so that it could not go astray into a communicating channel, and as well that its extremity could not impinge directly against the sac wall, which might result in subsequent puncture. The latter occurrence has happened in dogs.

In order that the coiled loops should not get snarled before using the wire, they were bound together over a short segment of each coil by a wire turned spirally around them, and the spirally shaped extremity was hooked into one of the turns. This fixation of the loops by the binding wire was done after the photograph had been taken, so that it does not show in the picture. To prevent snarling during the introduction of the wire, the spiral extremity, freed from its position of fixation, should first be started through the needle before the binding wire is removed from the coil, after which the binding wire should be removed, and then the loops can be kept from crossing one another by finger pressure over the site of binding the coil, which maintains the orderly arrangement of the loops so that they will unwind without tangling. The grip for holding the coil is that between the middle, ring, and little fingers and the palm of the one hand, which leaves the thumb and index-finger free for assisting the other hand with the manipulations of the wire. As the wire thus held is now introduced, it uncoils from off the hand after the manner of uncoiling a rope. This transmits a twist through the introduced wire with the passage of each loop, which, through the resiliency of the wire, enables the loops to re-form within

the sac. This technic of passing the wire through the needle should be practised in the open previous to operating. For a right-handed operator the spiral extremity must turn in the direction seen in Fig. 3. The hooking of the spiral extremity through one turn of the binding wire to prevent snarling of the wire before operation is important, since if this extremity crosses one loop of the coil, the uninterrupted uncoiling of the wire will be interfered with.

The shaping of this gold platinum "Clasp" wire in coils of the desired size is very laborious, and one cannot engage to operate at short notice unless the wire is already prepared. A circle of the selected size drawn on paper can guide the shaping of the loops, and a light weight laid across the loops as each succeeding one or two are formed facilitates the progress of the work. It is not necessary that the coiled loops should lie perfectly flat. In fact, an occasional change in the direction of the curvature sufficient to cause some riding up of a loop away from the horizontal plane is of advantage, since such deviation favors a spreading apart of the loops after their introduction within the aneurism.

The *needle* was of gold insulated with a covering of porcelain enamel, of a calibre just enough larger than the No. 28 wire to allow the free passage of the latter without friction, which relation in sizes enables the hemorrhage through the needle to be arrested by the passage of the wire. A needle with too small a bore, through which the wire can be passed only with friction, should be guarded against on account of the liability of kinking of the wire, just as much as one with so large a bore as to permit free hemorrhage with the wire threaded through it.

Both needle and wire were boiled in a $2\frac{1}{2}$ per cent. solution of sodium carbonate siccum in distilled water, but since this case was operated upon, experimental work has shown that it is better to omit the alkali.

The *current* (see p. 803), which should be direct, was taken from the illuminating fixture through a rheostat.

The *operating table* should be comfortably cushioned and covered with a rubber sheet.

Operation, November 24, 1911.—The needle, entering through a short skin incision, was made to puncture the aneurism near the eroded edge of the sternum, a little to one side of its most prominent portion, so as to avoid a thinned part of the sac. The three-inch diameter loops were first fed in from off the hand after the manner of uncoiling a rope. These larger loops of the wire encountered considerable resistance from the walls of the aneurismal cavity, which seemed to show that they were of a diameter greater than that of the sac. The smaller loops were fed in like the line off a reel and then the external wire twisted twice to try to snarl them. (This technic was here in error for the accomplishment of the purpose mentioned, since, with the introduced portion of the wire fixed within the aneurism, the further feeding in of the coil by unreeling would not permit of the loops re-forming after passing through the needle.) About 10½ feet of wire were introduced. The positive pole was connected with the external end of the wire, which latter trailed over a piece of rubber dam. A felt electrode, 12 x 10 inches, backed with rubber, saturated in a 10 per cent. salt solution, to the upper margin of which, at about the level of the root of the neck, the negative pole was attached, had at the start been placed against the patient's back so as to include the area corresponding to the aneurism.

The current used on this case was determined as the result of experiments on 117 dogs. It was raised in two minutes' time to 75 ma. which was maintained for 15 minutes. Then it was reduced to 50 ma. for 15 minutes, 40 ma. for 15 minutes, and 30 ma. for 15 minutes, and then discontinued. The greatest strength of current was employed at the start, in order to cause a primary injury of the lining of the aneurismal sac at the sites of contact of the wire.

In this connection it may be stated that in the course of wiring an additional 34 aortas in dogs since operating on this case, it has been found preferable to start the current at 100 ma. and then drop to 50 ma., 40 ma., and 30 ma., each for 15 minutes, with which technic the injury to the intima at the sites of contact of the wire was a little greater than when the current was raised to only 75 ma., and besides, the fibrin deposit at these sites of injury was a little greater in amount, firmer in consistence, and more strongly adherent to the arterial wall than with the weaker current. The practical superiority of the use of the stronger

current would seem to be supported by the result of its application to three cases of thoracic aneurism operated upon very recently, in all of whom the diminution in the pulsation was noticeable to the patients within eight hours following the operation, which is in contrast to the observation by the patient here reported that pulsation did not markedly diminish until the tenth day.

At the end of the electrical séance on the patient, the wire was first loosened within the needle, and then the needle was withdrawn over the wire held firmly in position. There was no hemorrhage from the puncture, and the wire was pulled out a little until the resistance of the fibrin covering its inner portion was felt, and was then cut off in the bottom of the wound.

Subsequent Course.—The constant pain was relieved promptly following the operation, but on coughing the patient had considerable pain at the seat of the fracture of the sternum. Prompt diminution of pain following this operation has been noted by Hare.²

On November 28 at 2 A.M. (fifth day) the patient had a sudden pain in his chest of great severity, which was much relieved by removal of a plaster strapping which had been placed around his fractured sternum. The tumor coincidentally had become more prominent, some of which swelling, anyway, was due to œdema.

The acute pain rapidly subsided, and on the following day, November 29, he had pain only on coughing, and he coughed less than before.

December 3 (tenth day): Pulsation for the first time was found to be markedly diminished. The change seemed to have come rather abruptly during the night. The patient himself had noticed it.

December 18, 1911 (twenty-fifth day): Patient has been up several days. He has no cough whatever. The tumor is little expansile. Occasional shooting pains in left nipple and inner side of the left arm. Up to this time during his stay in the hospital he has had no potassium iodide or mercury, which drugs were now administered.

February 28, 1912 (three months)³: The patient says he

² Hare: *Therapeutic Gazette*, 1908, p. 254.

³ May 11, 1912 (latest observation): The patient feels perfectly well, has no pain, and no shortness of breath unless he walks very fast. He walks about a mile every day. Occasional dry cough. There is a little increase in the force of the pulsation, which has varied in amount at different times. This change was first observed by the patient about March 6, soon after which the pulsation was observed to be of con-

can walk upstairs with perfect comfort, and that he feels perfectly well. No pain. The superficial tumor is practically obliterated, evidencing shrinkage of the sac. Pulsation can still be felt, though but very little expansile, and a bruit is still heard, showing that the sac is not obliterated. The aneurism reached its present state of quiescence about eight weeks after the operation. Very occasional dry cough.

A stereoscopic X-ray picture of the wire *in situ*, taken February 27, 1912, by Dr. L. T. Le Wald, at the Edward N. Gibbs Memorial X-ray Laboratory, here reproduced (Fig. 4), demonstrates the loops of wire forming essentially a globular skeleton framework, which evidently outlines the limits of the sac. Thus the principle of contact of the wire with the lining of the aneurismal cavity is seen to have been carried out in this case through the technic employed.

PRINCIPLES OF THE TECHNIC HERE ADVOCATED.

These principles were formulated as a result of observations on the previous case of innominate aneurism, the case here reported, and three other very recent cases, besides the experimental work on the 151 dogs.

1. The wire should be one having the properties of the gold platinum "Clasp" alloy (p. 802), viz., it should be resilient and it should not dissolve under the influence of the electrolysis. The resiliency enables the loops, with proper technic, to re-form within the aneurism, so that the disposition of the wire is more or less under the control of the operator.

In contrast to this wire, a silver wire alloyed with $7\frac{1}{2}$ per cent. copper (Hunner⁴ and Finney⁵) is not resilient, and under the influence of an electric current fluctuating between 35 and 50 ma. in the blood stream of a dog's aorta for 48 minutes it corroded, dwindling to about one-third its original size, and broke spontaneously at a

siderable violence. By April 20 there had been a slight return of symptoms, at which time the patient confessed that he had been indulging rather freely in the use of tobacco. On stopping the tobacco the symptoms promptly subsided. The aneurism has become a little prominent again.

⁴Hunner: Johns Hop. Hosp. Bull., xi, 1900, p. 263.

⁵Finney: ANNALS OF SURGERY, lv, 1912, p. 661.

point outside the artery where it lay in clotted blood. The clot deposited on this wire was fibrinous. Another wire of 12 carat gold, the alloy of which could not be determined, under the influence of a current around 50 ma. for 85 minutes, similarly corroded and broke outside the aorta of a dog, and on removal of the specimen the intra-aortal portion of the wire fractured into fragments. The clot in this case was very large in amount, dark red in color, and not at all fibrinous but of a clay-like or doughy consistence. Along the site of the wire this clot presented a metallic stain. The question would arise whether a pasty coagulum of this sort resulting from the use of a particular kind of wire would be capable of undergoing organization. This decomposition of the wire under electrolysis may elucidate happenings like those reported by Willson⁶ and by Hare⁷. In the former's case the X-ray showed no trace of any wire. The wire, probably a gold one, under the influence of a current of 20 ma., had burned off during the operation and Willson believed it had been destroyed by the current. In Hare's case, at autopsy four months following the operation, there was no trace of 18 feet of gold wire which had been introduced into an innominate aneurism.

2. The wire should be made to come as extensively as possible into contact with the lining of the aneurism, so that the electric current can injure the same, thereby producing areas for the adhesion and organization of the fibrinous clot deposited by the electrolysis along the contiguous portion of the wire, as well as for the deposit and organization of laminated fibrin.

In attempting to bring as much of the wire as possible into close relation with the inner surface of the aneurismal wall, the problem is a little complex because of the inability to determine definitely the diameter of the aneurismal cavity from which to gauge the size to coil the wire. The percussion note and the X-ray shadow will contribute some information.

⁶ Willson: *Trans. Coll. Phys., Phila.*, 3, S, 1908, xxx, p. 33.

⁷ Hare: *Trans. Coll. Phys., Phila.*, 3, S, 1908, xxx, p. 28.

Borne out by the result in the case here reported, it would be well if the diameter of the loops of the wire as coiled before operation could a little exceed the diameter of the aneurismal cavity. If at operation this disproportion in size is found to be reversed, the diameter of the cavity being greater than that of the loops, as evidenced by the fact that the wire feeds in freely through the needle without encountering the resistance of an opposing surface, then it is the writer's proposition to give the external portion of the wire extra twists in addition to those which occur naturally from the uncoiling of the wire from off the hand, seeing to it that the former twists are made always in the same direction as the latter. This manœuvre, through the resiliency of the wire, should throw apart the loops which have passed through the needle, snarling them into a skeleton framework of a greater diameter than the diameter of the original coil, so that the peripheral loops would then make a good contact with the walls of the aneurism.

The writer is inclined to believe that for all but very large aneurisms, the slender No. 29 filament coiled in large loops can be used to advantage. A sizable loop of this wire ought to be able to adjust itself within the confines of an aneurismal cavity of a much smaller diameter than its own, without risk of causing pressure necrosis. A No. 29 wire coiled in loops varying in diameter between $4\frac{1}{2}$ and $5\frac{1}{2}$ inches, on being introduced into a globular flask $3\frac{1}{4}$ inches in diameter, readily took a peripheral arrangement around the inside of the vessel. Thus this size wire thus coiled might be used for any aortic aneurism of a diameter less than that of its own loops.

3. The introduced extremity of the wire should be spirally shaped for the reasons already given (Fig. 3).

4. Unless the insulated gold needle be known to be made of an alloy which is not decomposed by electrolysis, it would be as well to test it in a dog before use on a patient.

5. In case the needle is likely to have to make a deep puncture to reach the interior of the aneurism, it can, before its introduction, be pricked through a little square of rubber

dam, which will insulate its outer extremity should the latter come into contact with the superficial wound.

6. The needle and wire should be boiled in distilled water.

7. The negative electrode should be placed against the back directly over the area corresponding to the aneurism and should more than cover this area. The writer, for use on the patient, attached the negative wire at the upper edge of this electrode, but he now believes that theoretically it should rather enter at the centre of the latter just opposite the aneurism. Dr. Homer F. Swift made the suggestions that the size of the area covered by the indifferent electrode and the relation of the negative to the positive pole probably made a difference in the evenness of the clot formation along the wire in the blood stream. The experimental results confirmed the truth of the suggestions. When a small area of the animal's back was shaved for contact with the negative electrode, the clot formation along the wire was very irregular, but when the whole back from neck to hips was shaved and the animal laid on a 14-inch long electrode, the results were notably improved. It was further noticed that if the site of attachment of the negative wire to the electrode were at a low point of the back opposite the site of entrance into the aorta of the gold wire, to which latter the positive pole was attached, the inner extremity of the gold wire lodged near the arch of the aorta would be scantily coated with fibrin, but that with the position of the electrode reversed so that the site of attachment to it of the negative wire came about opposite the arch of the aorta, then the inner extremity of the wire would receive a greater amount of fibrin deposit. These effects can be explained by the fact that the electric current passes through the body with greatest intensity in the line of the shortest distance between the two poles, and the whole length of the wire lying in the aorta is consequently acted upon evenly only when the poles are placed at its opposite ends.

8. It is as well that the external portion of the wire during the passage of the current should trail over a piece of rubber dam.

9. The principle in the use of the current as here set forth is to begin with a high current (100 ma. for 15 minutes, raised to this point at the start in 2 minutes' time), which will to a sufficient degree injure the intima at the sites of contact of the wire, and then lower the current to the strengths successively (50 ma., 40 ma., 30 ma. each for 15 minutes) which were found in the experimental work to be the combination most favorable for the production of a firm fibrin deposit that would become adherent to the sites of trauma during the passage of the current (Fig. 5). In the experiments where the 100 ma. current was used at the start, it was found that the fibrin deposit on the wire at the sites of trauma of the intima would be greater in amount than that in the intervals.

10. *The control of hemorrhage.* The site of puncture should be at a thickened portion of the aneurismal wall rather than at a thinned portion. The needle should be of a calibre just enough larger than the wire to allow the free passage of the latter without friction, which relation in sizes enables the hemorrhage through the needle on its introduction to be arrested by the passage of the wire. On the withdrawal of the needle, when the puncture has been made through a thickened portion of the sac wall, the hemorrhage seems to become easily self-arrested, particularly if the wire be pulled gently outward until the fibrin-covered portion within the sac, just beyond that which had been sheathed by the needle, is felt to have been drawn firmly against the interior aspect of the puncture. In case, for any reason, on withdrawal of the needle a free hemorrhage should arise which would seem unlikely to be controlled by ordinary measures, the writer would suggest, before cutting the wire off, the starting up of the electrical current again at 50 ma. In most of the animal experiments the needle was withdrawn from the aorta immediately after passing the wire, with resulting free hemorrhage from the puncture, which, temporarily arrested by the gloved finger, could invariably be controlled by a 50 ma. current, usually within 3 minutes' time and rarely in longer than 9 minutes. In four recovery experiments where this technic was employed (the puncture being unprotected by any in-

sulation throughout the electrical séance), and the wire was left protruding through the puncture at the end of the operation, the puncture was found at autopsy to be tight. One of these animals (highest strength of current, 50 ma.) was autopsied on the fifth day after operation, another (highest strength of current, 75 ma.) on the fourth day, and two (highest strength of current, 100 ma.) after 10 and 12 weeks respectively. In both of the latter the wires had shifted from their original positions, each having worked back through the puncture for about 2 inches into the subperitoneal tissues, where the extruded portion was found encased in scar tissue.

11. It is a well-established principle that the positive pole should be attached to the gold wire and the negative pole to the electrode against the back. In a dog with the current reversed, the negative pole being attached to the wire in the aorta and the positive pole to the electrode against the back, neither trauma of the intima nor the deposit of any fibrin along the wire took place.

SOURCES OF TROUBLE.

The Wire.—The right kind of wire has recently been difficult to get, until its identity with the gold platinum "Clasp" alloy was established. In order that any scientific value which his work might possess should not be nullified by a possible disappearance of this particular brand of wire from the market, the writer has had a piece of the gold platinum "Clasp" wire assayed, and it is reported to be made up of the following alloy: gold, 62.9 per cent.; silver, 17.9 per cent.; platinum, 13.4 per cent.; copper, 5.8 per cent.

The drawing of the wire to the proper fineness is difficult, as the wire is very liable to break during the procedure, and the required length may be forthcoming only after much patient work. This is particularly true in drawing the wire down to size 29.

The coiling of the wire as here suggested is laborious.

Unskilled hands may inadvertently snarl the wire, so that personal supervision of the handling of the latter is recommended.

The Needle.—The needle is very liable to get plugged by the clot which forms within it alongside the wire, which complication can take place in the following wise: If the external piece of wire over which the needle is threaded at the end of the operation be withdrawn without first cleaning the bore, it will be found that on reintroducing the wire through the needle the débris within the lumen will be jammed together into a solid mass which can be removed only by drilling. Drilling necessitates breaking of the porcelain enamel covering, and to effect re-enamelling special furnaces and special skill are required. To avoid this series of complications, the piece of wire left threaded through the needle at the end of the operation should not be withdrawn until it has first served the purpose of cleanser by being pulled alternately in opposite directions through the bore of the needle, after first soaking the latter with the wire threaded through it in cold water. A blow upon the needle, such as that received as a result of letting it drop upon a hard floor, will also chip off the enamel.

Electrical Current.—The electrical current taken from a storage battery is very liable to lose in intensity during the period of its use, and is very sure to do so if the battery has not been freshly charged. The direct current taken from an electric fixture through a rheostat gives a steady flow. With the use of the rheostat certain precautions should be taken to prevent short-circuiting, which, if it occurs, will disable the instrument. It is therefore recommended that the current be not turned on at the socket in the fixture until all the manipulations of the wires connected with the rheostat be completed. Also that when the electrical séance is finished, the connection at the socket should first be interrupted before the wires are again handled.

All the wire connections should be made tight before starting, since a loose connection might interrupt the current, which would result in giving the patient a shock. Also the main switchboard should be carefully guarded, lest, during the séance, some one should inadvertently shut the current off.

If the rheostat be used, it would be well to have an extra one in reserve.

ADHESIONS OF THE UPPER ABDOMEN.*

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ON account of changes in position of viscera at different stages of development of the embryo, the peritoneum seems peculiarly apt to retain anomalous features, after following organs to their permanent sites. Folds which ordinarily undergo obliteration before the birth of the child, sometimes remain as permanent defects. An organ as large as the liver, with its long and tortuous course to position in permanent site, seems to carry in its vicinity more defects of the peritoneum than are found with other organs from the endoderm. The gall-bladder and the cystic duct may retain a complete post-natal mesentery, consisting of a double serous fold enclosing blood-vessels and nerves, and which persists through adult life. Lesser defects are frequently shown in abnormal bands of the gastrohepatic omentum or of the gastrosplenic omentum. The right free margin of the former connects the liver and duodenum, and may form a short but strong ligament sufficient to angulate the duodenum in a way to give a radiographic picture suggestive of undue fixation of the pylorus and first part of the duodenum. Many small anomalous peritoneal bands remain between various parts of the liver, parietes, and upper abdominal organs. These peritoneal defects seem to be caused by lack of normal adhesion of apposed peritoneal surfaces during fetal development.

Reference to the presence of peritoneal abnormalities in the upper abdomen, due to lack of normal adhesion of surfaces in fetal life, is introduced in a preliminary way in this paper, for purposes of contrast with peritoneal adhesions developed in post-natal life as a result of inflammatory processes.

* Read before the New York Surgical Society, March 13, 1912.

It is probable that embryonic peritoneal defects cause little disturbance of function of organs, because of compensatory changes which take place in the course of development. It is certain, on the other hand, that defects of post-natal inflammatory origin may cause serious disturbance of function of viscera. The importance of distinguishing between developmental defects of embryonic origin and defects of post-natal inflammatory origin will impress one more and more as he makes notes relating to the subject. In the early stages of observation, there is sometimes difficulty in distinguishing between the two kinds of defect, but one soon learns to know them apart. A certain definiteness in outline of the congenital defects, with an order of arrangement harmonious with the anatomy of the region, is in evidence, and these embryonic derelicts commonly have a smooth covering of endothelium. Abnormal peritoneal bands of congenital origin often contain adipose inclusions, or may even carry fatty appendages. Post-natal inflammatory defects of the peritoneum give one the impression of disharmony with the general anatomy of the region. Their surfaces may be covered with endothelium, much like that of the normal peritoneum, but there is a suggestive irregularity in form and position of adhesion bands, and they do not contain adipose inclusions.

Congenital peritoneal defects and acquired inflammatory defects not infrequently occur together in the same individual, but the acquired defects of inflammatory origin are apparently the only ones with which surgeons need to deal in work in the upper abdomen. If the Lane's kink escaped observation for so long a time, and if so small a defect is now known to give rise to such well-marked symptoms, one may readily assume that still more extensive adhesion defects in the upper part of the abdomen give rise to more complicated kinds of disturbance. These adhesions, to which I referred some years ago as "cobwebs in the attic of the abdomen," are still generally overlooked by diagnosticians and in post-mortem examination, in very much the same way as we overlooked ad-

hesions in the region of the appendix until the attention of the profession was turned to the subject of appendicitis, twenty-five years or more ago.

The first observation made by the author relating to adhesions in the upper part of the abdomen led to the conclusion that they proceeded from toxic influences associated with the bile tract. It seemed probable that bacteria carried to the liver by the afferent vessels of the portal system, and excreted by the liver, made demonstration in the vicinity of the bile-ducts, either through the influence of toxins escaping through the thin-walled ducts, or through the activities of bacteria remaining and undergoing development in this region. A later view seemed to include the idea that toxic processes influencing the peritoneum of this region were not confined to bacteria or toxins arriving by way of the liver. There seemed to be in addition, toxic impression made by bacteria in the vicinity of the pylorus and duodenum in cases in which no such definite lesion as ulcer had been present. As yet it is difficult to state whether this impression is made by bacteria on the mucous surface of structures in the vicinity, or by bacteria actually escaping into the peritoneal cavity. The idea that bacteria may escape into the peritoneal cavity in this region bodily, seems to be upheld by the finding of bacteria resembling the colon bacillus enmeshed and latent in adhesion tissue of the region.

Adhesions are probably formed after toxic desquamation of endothelium. Plastic lymph exudate then becomes organized and remains in the form of adhesion tissue, binding various structures together. No matter in what way inflammatory adhesions are formed, there is introduced a mechanical obstruction to peristaltic motility of hollow viscera engaged in adhesions, and there is interference with the movement of one viscus upon another in the adjustments which occur momentarily with ordinary movements of the body. The hyperplastic connective tissue resulting from organization of lymph exudate undergoes contraction characteristic of such tissue at some points, or it may be pulled out into long bands.

The latter have a tendency to undergo absorption, unless there is renewed adhesion formation in the vicinity from time to time. No doubt such renewed inflammatory process is common to most of the cases in which upper abdominal adhesions occur. This assumption is based upon the belief that toxic impression upon the peritoneum occurs in patients with defective digestive processes, and that adhesions once they become established exert a retroactive influence; that is, faulty digestive processes allowing toxic impression to be made upon the peritoneum of the upper abdomen in the first place are subject to still further derangement through the mechanical influence of acquired adhesion later.

The symptoms belonging to adhesions in the upper abdomen are apt to lead to a diagnosis of some other condition; for instance, we may have angulation of or interference with the cystic duct of the gall-bladder, requiring spasmodic action of the gall-bladder to force contents past the obstruction. In such a case the symptoms may be those of gall-stones. Adhesions interfering with the common bile-duct may even lead to jaundice, although this symptom is not so common as the symptom of spasm in the effort of the gall-bladder or bile-duct to force bile past points of obstruction. Very many patients have been operated upon who presented a fairly clear history of the presence of gall-stones, and yet no gall-stones were found at the operation—nothing but adhesions in the vicinity. Adhesions interfering with peristalsis of the pylorus and duodenum may give rise to symptoms closely simulating those of ulcer of these regions. The author has under his care at the Post-Graduate Hospital at the present writing, a man who gave a good history of duodenal ulcer, according to careful tests made by expert diagnosticians in this special field, and yet at operation nothing was found excepting extensive adhesions in the vicinity of the duodenum. The duodenum on being opened showed no sign of ulcer and no induration of its walls. The case was typical of a number seen by the author. In this case we noted the enlarged lymph-glands of the pancreas belonging to pancreatic lymphangitis,

as recently described by Deaver. Such pancreatic lymphangitis is probably only one result of the local toxic processes which lead to adhesion formation.

Persistent hyperchlorhydria is a feature in the history of these adhesion cases. Abnormal retention of food in the stomach is noted, and fluoroscopic examination may show fixation of the pylorus or of the free part of the duodenum, and interference with the peristaltic wave. There may be rigidity of the upper part of the rectus muscles, tenderness on pressure at Robson's point, hyperæsthesia in the gastric zone of Head, and yet nothing more than adhesions found at operation. There is absence of blood from the stomach or bowel, and that is sometimes the only feature of distinction in a clinical way between the condition of adhesions and the condition of ulcer.

At the present moment the author has no data referring to the influence of adhesions upon the pancreas, but it is fair to assume that some of the cases of pancreatitis, acute and chronic, may be due to mechanical interference with the pancreatic duct.

Adhesions interfering with duodenal peristalsis or with colonic peristalsis, when they extend to engage the hepatic flexure of the colon, as often enough occurs, seem to lead to more or less intractable constipation. The acute stages of inflammation leading to adhesion formation may be definite at the time when we have such acute infection of the upper abdomen. They may be subacute at the time when we make a diagnosis of gastroduodenitis or catarrh of the bile-duct. They may be insidious when the patient complains of nothing more than a persistent unaccountable tenderness in the epigastric region. At all such times we assume that toxic desquamation of peritoneal endothelium may be under way, and that adhesions are in process of formation.

Aside from mechanical interference with peristalsis of the hollow viscera, we may assume that disturbances of secretion and excretion result from the presence of adhesions in some cases. Derangement of hormone secretion at the pylorus, due

to adhesion irritation, might lead to various gastric disturbances, ranging from rather intractable dyspepsia of low grade up to acute indigestion, but the derangement of hormone secretion doubtless belongs more properly to the acute toxic stages.

It is possible that we may place all this local irritative influence back upon the responsibility of the liver after all, and find that infection in the vicinity of the exit of the common duct is due to excess of toxins at this particular point, just as a stream is most cloudy at the point where a sewer discharges. Features associated with infections in other parts of the abdominal cavity indicate that such may be the case. When we have, for instance, appendicitis and simultaneous cholecystitis or simultaneous ulcer of the stomach, it would seem to indicate that the greater the proportion of toxins excreted by the liver, the greater the proportion of cases of cholecystitis and ulcer of the stomach occurring synchronously. Infection having led to adhesion formation, adhesion formation leads in turn to disability of affected organs, leaving them more vulnerable to subsequent infection.

The degree of adhesion formation present in any given case cannot be foretold by the symptoms. The author has found pylorospasm, dilatation of the stomach, and grave digestive disturbance, when a comparatively small band of adhesions has engaged the duodenum. At other times nothing more than indefinite dyspeptic symptoms have been present in cases where a very large area, including the duodenum, pylorus, colon, bile-duct, and liver, was engaged in adhesions. The response of the individual patient then, to the influence of adhesion irritation, interferes with the value of testimony relating to the extent of adhesions in his case.

Periodicity of symptoms is quite as well marked in simple adhesion cases as it is in cases of ulcer of the duodenum.

Patients will suffer from acute digestive disturbance, passing into the chronic stage. They may have hyperchlorhydria or hypochlorhydria, which will clear up under medical treatment, and the patient then enjoys a fair degree of health

until the next attack. This history of periodicity of acute attacks of disturbance with adhesions is so closely that of the history of ulcer of the duodenum that we shall probably have difficulty in making differential diagnosis excepting at operation, and perhaps even then. If adhesions and ulcer are found together we cannot know which feature was the dominant factor in symptom production.

Treatment of adhesions consists in separation and the adoption of methods for preventing their recurrence. My own practice has been to stop at this point in operating when there was no history of blood in stools or stomach, and no point of induration suggestive of ulcer or ulcer scar.

In cases in which we have blood in stools or stomach, or induration of walls of viscera, appropriate steps are taken in addition to adhesion separation.

For preventing recurrence of adhesions several resources are of value. When adhesions have been separated over a small area and there is not much oozing of blood, aristol dusted upon the region and allowed to remain for a moment, until lymph coagulum has formed, is beneficial.

When there is a considerable degree of oozing after separation of adhesion surfaces, sheets of Cargile membrane may be used, the difficulty here being to place the membrane properly, as this tissue is not easily handled with moist fingers. It is best managed by laying it first upon a square pad of dry gauze, pressing gauze and membrane together upon separated adhesion surfaces, and then removing the gauze quickly at the moment when viscera fall back into place.

A third resource consists in smearing recently separated adhesion surfaces with sterilized vaseline. This resource is employed in cases in which for any reason there is difficulty in obtaining an aristol-lymph coagulum, or in covering widely separated adhesion surfaces with Cargile membrane.

Surgical methods for preventing recurrence of adhesions are mechanical in nature, and relate to the date of operation. We must bear in mind the probability that the original tendency to adhesion formation still remains with the patient, unless disorders of digestion are taken in charge by the physician.

INVOLVEMENT OF REGIONAL LYMPHATIC GLANDS IN CARCINOMA OF THE STOMACH.

FROM A STUDY OF 200 RESECTED SPECIMENS.

BY WILLIAM CARPENTER MacCARTY, M.D.,

ASSISTED BY

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AN historical review of gastric therapeutics should give the surgeon credit for having demonstrated that all palpable tumors of the stomach are not inoperable, a fact learned from experience in palliative surgery, especially in cases in which the surgeon tried to save the patient from starvation by resection or gastro-enterostomy. Patients with extensive lesions in the stomach often lived comfortably over a period of several years. This was far beyond the expectations of the surgeon.

Such clinical and operative experience and the close association of carcinoma with gastric ulcer—which has been demonstrated by the surgical pathologist—have led conservative but progressive surgeons to explore, in doubtful cases, rather than to guess about the abdominal contents. Many cases which were considered clinically “inoperable” have been found to be operable; many carcinomatous stomachs have been diagnosed clinically simple gastric or duodenal ulcers; many “gastric ulcers” have been found to be ulcers of the duodenum; and many lesions in the gall-bladder, duodenum, and appendix have been mistaken for gastric ulcers.

Recognition of the operability of cases, which a few years ago were considered inoperable, has been a great step forward in the art and science of operative gastric therapeutics. Some patients have been completely cured of gastric disturbances, many relieved for a period of years, and others saved from a death of starvation.

Good results have been doubtless due in part to irregularity in the rapidity of lymphatic involvement—a condition in gastric carcinoma which has occupied the attention of operators and pathologists since the pioneer days of gastric surgery. Lengemann¹ studied the regional lymphatic glands,* which were removed with specimens of carcinoma of the stomach in the clinic of Mikulicz. Renner,² in the same clinic, studied the lymphatic involvement in gastric carcinoma in 15 cases which came to autopsy. Cuneo³ studied carcinomatous stomachs from eight autopsies in cases which had not been operated upon, one case at autopsy in which a gastro-enterostomy had been done, and thirteen cases in which gastrectomy had been performed. The last observer paid special attention to the lymphatic system of the wall of the stomach and the lymphatic glands, which he studied by means of a modification of Gerota's⁴ method of injecting the lymph spaces and vessels (Fig. 6).

Lengemann¹ and Renner² charted the involved glands in a manner somewhat similar to that adopted for this series.

The material for this investigation, which is a continuation of a study made on gastric ulcer by the writer,⁵ consists of 200 specimens which had been resected or excised from the carcinomatous stomach. Each specimen was examined immediately after its removal and again in a fixed condition. The location and size of the primary lesion and the location and the relative size of the lymphatic glands of the lesser and greater curvatures were noted and recorded upon diagrams (see charts). One-half of each gland was numbered and fixed in 4 per cent. formaldehyde solution (10 per cent. formalin), frozen, cut, and stained with hæmatoxylin and eosin. All lymphatic glands were examined microscopically and the diagnosis recorded on its respective diagram (see charts). Lymphatic glands which were found to be inflam-

*The term "lymphatic glands (lymphoglandulæ)" has been adopted by the writer according to the nomenclature recommended by the "Anatomische Gesellschaft" at the ninth meeting in Basel and published under the title "Die Anatomische Nomenclatur (Nomina Anatomica)" by Wilhelm His,¹³ Leipzig, verlag von Veit and Comp, 1895.

matory without carcinomatous involvement were examined several times in order to rule out the possibility of involvement in some other portion of the block than the one examined. Absolute accuracy would depend, however, upon serial section of each gland. This is not feasible in a large series of specimens. One thousand four hundred and four lymphatic glands were examined. During the microscopic investigation photographic records were made.

A clearer conception of the material of this paper may be obtained by first reviewing the results of a previous study by the writer⁵ of the same material to determine the character of the process of ulceration in the wall of the stomach. Two hundred and sixteen resected or excised specimens of the stomach were examined. These consisted of simple ulcers, ulcers associated with carcinoma, and carcinoma so advanced that its development upon ulcer could not be determined. In a study of this material it was seen that an initial erosion or partial destruction of the gastric mucosa occurred as the apparent forerunner of extensive ulceration. Why and how the initial disturbance occurred was undetermined. The process of destruction after the initial lesion had occurred was, however, apparent in many of its phases.

It has been shown that gastric ulcers sometimes become healed—scars of old ulcerations having frequently been found at autopsies in general hospitals. Why all gastric ulcers do not heal spontaneously remains an unanswered question. In the previous investigation it was noted that lesions apparently continued with gradual deepening of the ulcer. In many cases this seemed to occur very slowly or periodically. The chronicity of these lesions was shown from the fact that changes, such as the presence of dense scar tissue, lymphocytic infiltration, epithelial hyperplasia, and glandular distortion, occurred in practically all ulcers seen in the series. The clinical course of all cases which were studied also bore out their chronic character. It was also found that the base of a gastric ulcer might consist of any of the coats of the stomach (mucosa, muscularis mucosæ, submucosa, muscularis, subserosa or peritoneum). These were often greatly distorted

by marked inflammatory reactions. Various stages of extension of gastric ulceration through the wall may be seen in Figs. 1 and 2 (*a*, *b*, and *c*).

The border of the mucosa in such specimens was almost invariably hypertrophic, the gastric glands were distorted and often cystic or dilated (Figs. 3 and 4). The epithelial cells were in a condition of hyperplasia; in simple ulcers these cells had attained morphologic development and perhaps their physiologic differentiation. The last two features serve well as an aid in the differentiation between inflammatory or simple irritative epithelial hyperplasia, and the apparently morphologically undifferentiated and physiologically undifferentiated epithelial hyperplasia of carcinoma. In the latter condition the cells were found to be passing through stages similar to those described in carcinoma of the breast.⁶ They invaded surrounding tissues only when they were morphologically undifferentiated.

The underlying coats of the stomach and the base of the ulcer apparently became secondarily involved from some point in the mucosa. Epithelial cells apparently entered the lymphatic spaces of the mucosa and followed the channels described by Cuneo,³ Sappey,⁷ and Most.⁸

According to Cuneo³ the lymphatic space between the gastric glands (Fig. 6) are intercommunicating, form large spaces in the submucosa, pass through the musculature, collect in the subserosa, and enter lymphatic channels just under the peritoneum. This gastric intramural lymphatic system empties its contents into the extramural or regional lymphatic glands. The glands upon the specimens in this series are divided, according to Cuneo's classification, into the lesser curvature, subpyloric, retropyloric, and greater curvature groups (Fig. 5).

The relation of the primary lesion—carcinoma—to the amount of lymphatic involvement and the relation of these to the clinical histories were the objects of this investigation, which is a part of a general investigation by the writer of gastric ulcer and gastric carcinoma.

Primary lesions varied from 1 cm. to 14 cm. in diameter

FIG. 1.



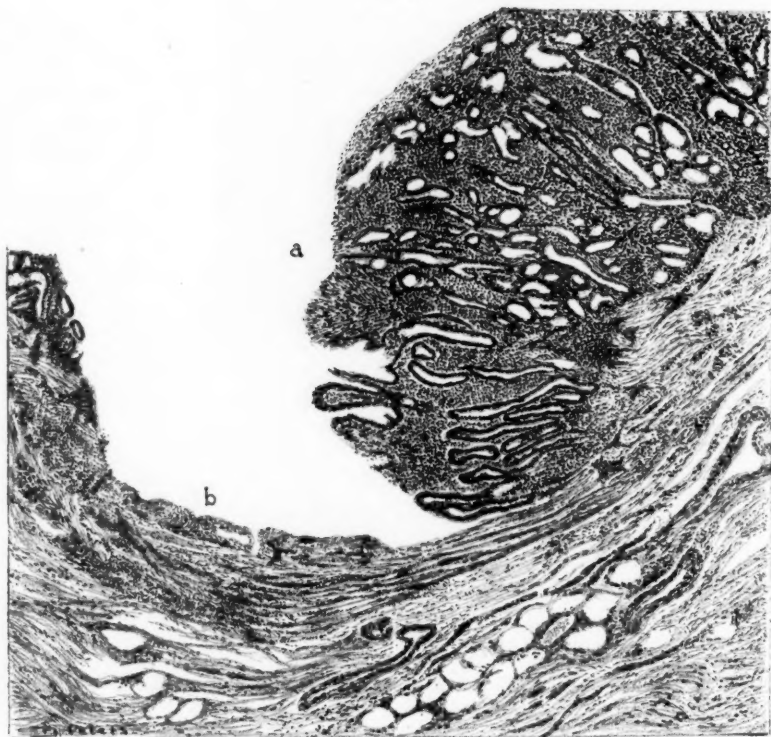
Case 18088, Group III. Multiple gastric ulcers, showing them in various stages.

FIG. 2.



Case 18088, Group III. Gross section through the ulcers in Fig. 1. *a*, small ulcer of the mucosa; *b*, ulcer invading the submucosa; *c*, largest ulcer showing the dense scar tissue in the muscular wall and extending to the serosa.

FIG. 3.



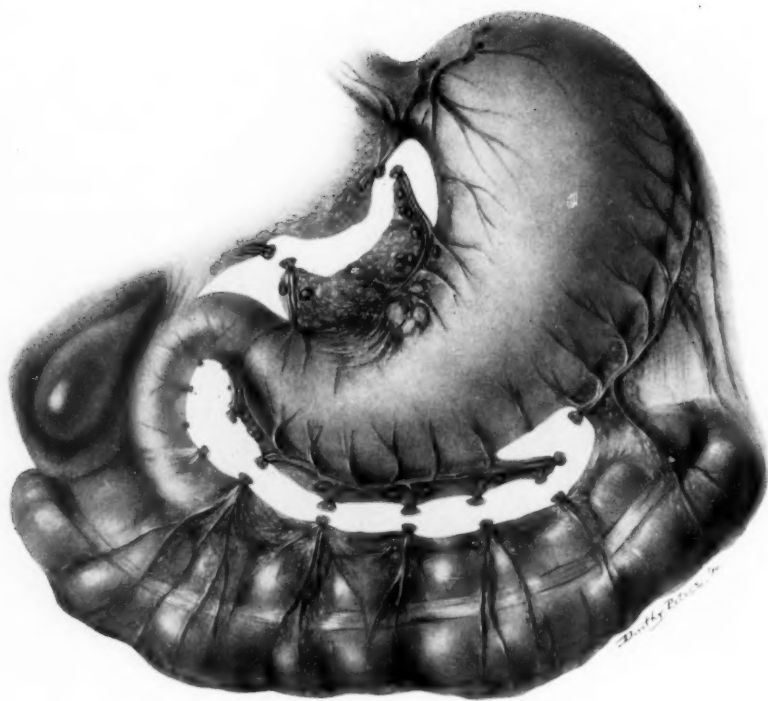
Case 25692. Microscopic section through the border of a simple gastric ulcer with a characteristic border and base. *a*, hypertrophic mucosa; *b*, dense scar tissue base.

FIG. 4.



Case 21555. Microscopic section through the carcinomatous border of a gastric ulcer. *a*, hypertrophic mucosa, cystic, and hypertrophic glands; *b*, invading glandular elements in the submucosa.

FIG. 5.



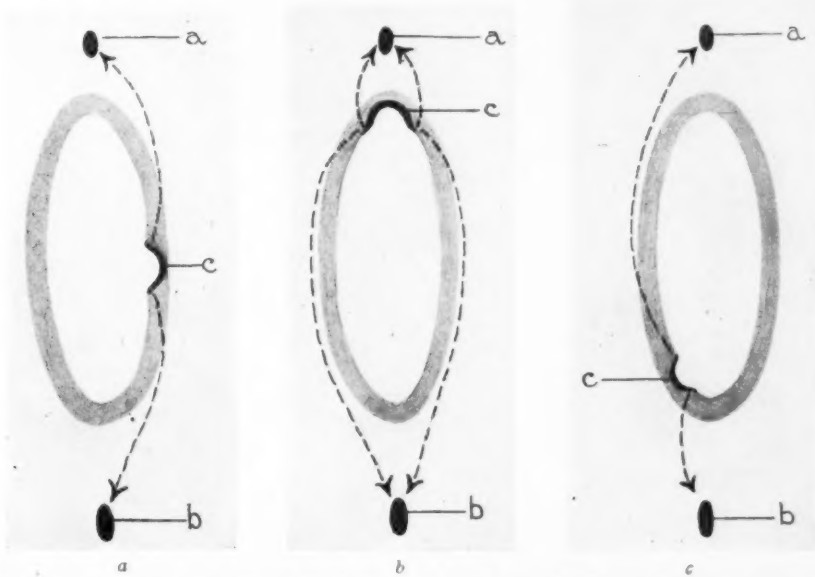
Portion of the stomach usually resected, showing the location of the glands investigated in this study. (Mayo.)

FIG. 6.



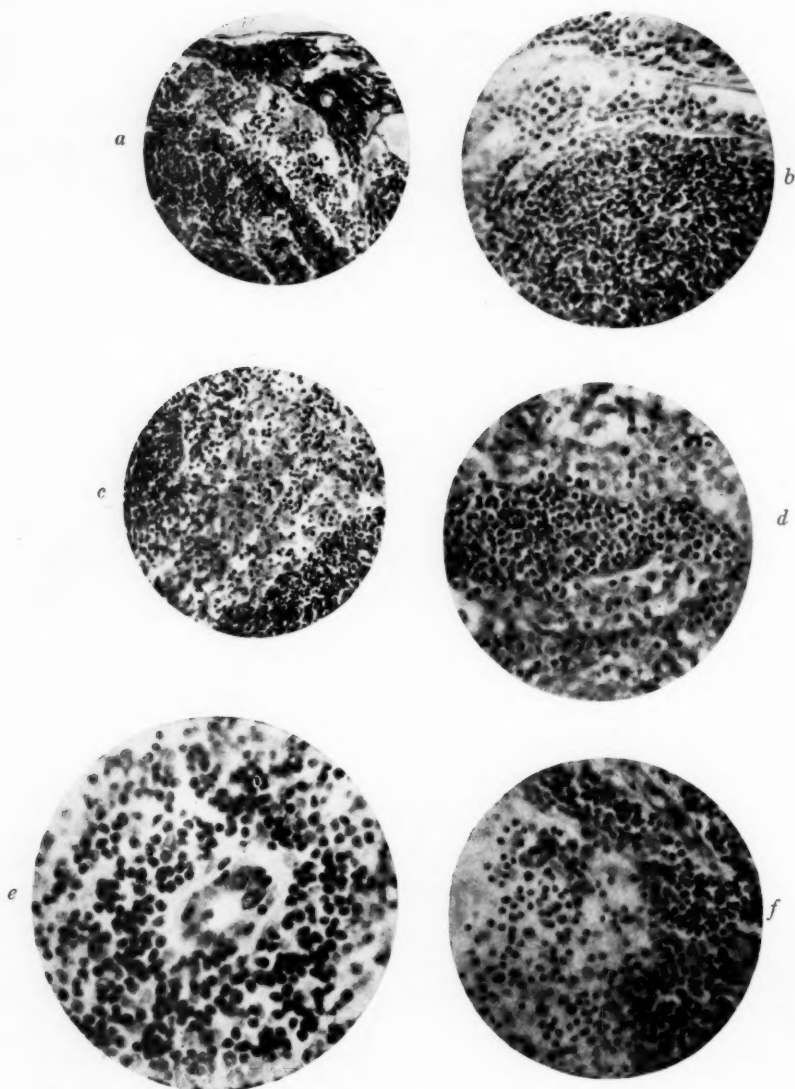
Diagram of wall of human stomach, showing injected lymphatic channels. (From Cuneo.)

FIG. 7.



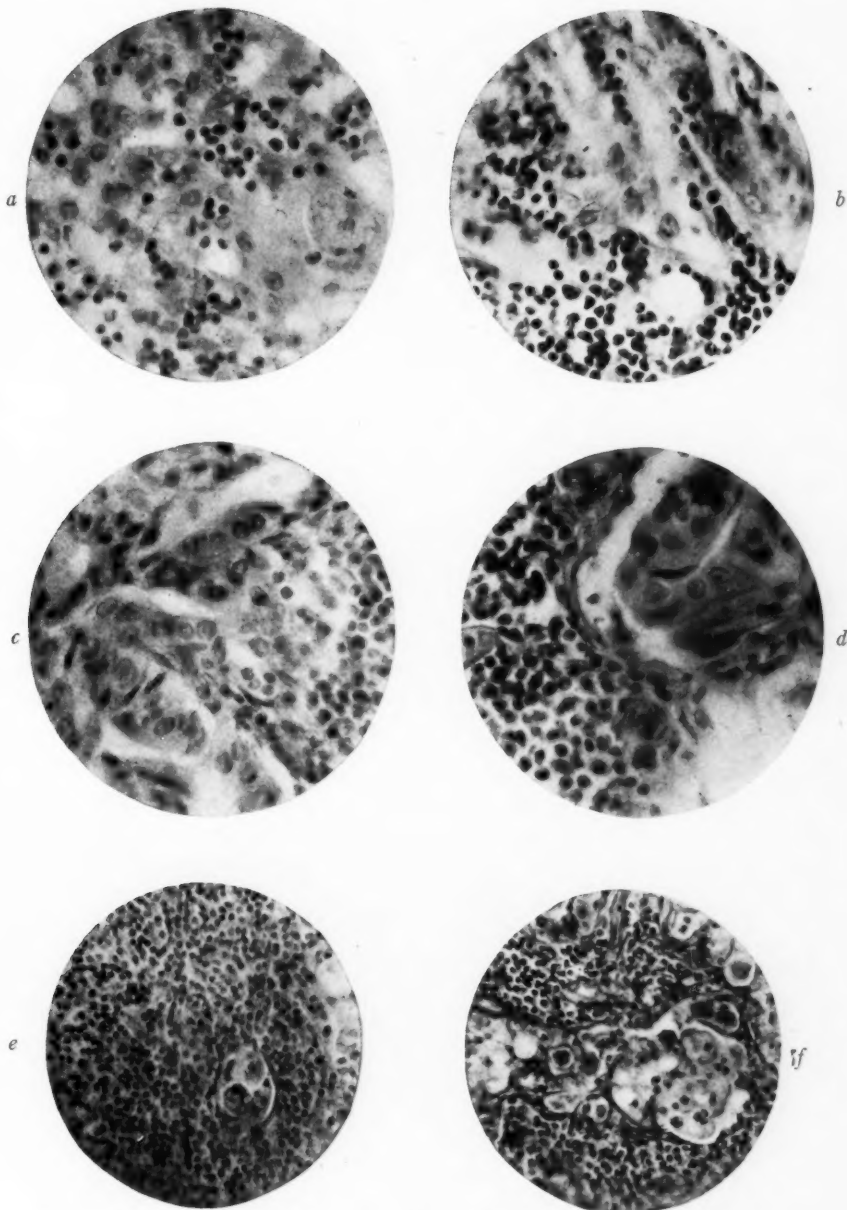
Diagrams of transverse sections of the wall of the stomach, showing hypothetical carcinomatous ulcers (c) and the directions of the resultant carcinomatous invasion of the lymphatic glands (a, b).

FIG. 8.

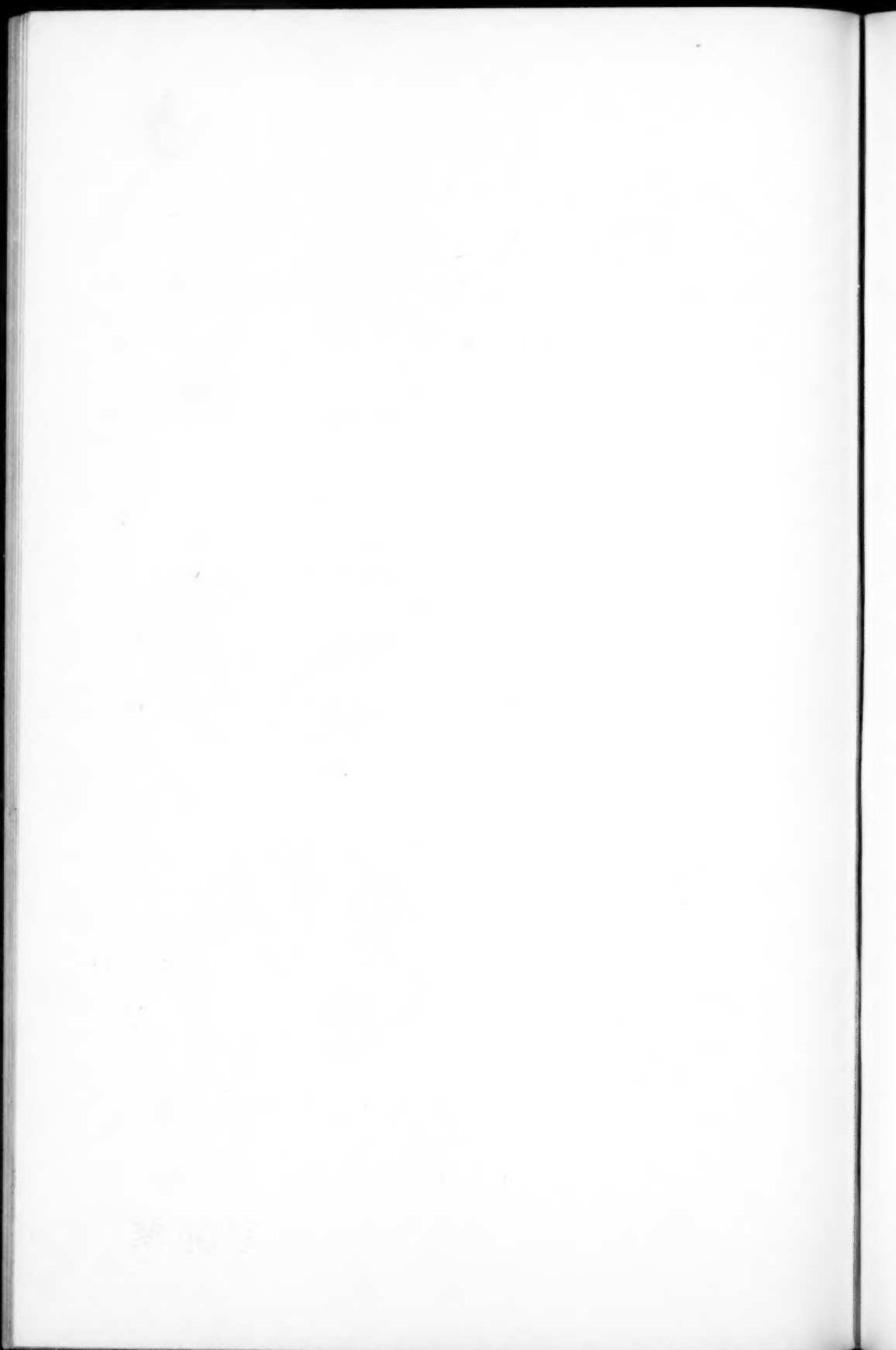


a, section showing a sinus of a lymphatic gland filled with lymphocytes and coagulated lymph; *b*, sinus in the deeper structure of a lymphatic gland; *c*, sinus filled with lymphocytes and exfoliated endothelial cells; *d*, sinuses containing coagulated lymph, lymphocytes (darkly stained), and endothelial cells (faintly stained); *e*, large endothelial cells lining a vessel which may be confused with groups of epithelial cells in carcinomatous invasion; *f*, sinus filled with lymphocytes, coagulated lymph, and large cells. The largest cell in the field is probably an epithelial cell.

FIG. 9.



a, lymph sinus containing large cells with clear pale nuclei. The lymphocytes are much darker. The exact denomination of these cells is extremely difficult. They are probably carcinoma cells in this case, although it is impossible to be absolutely certain. *b*, lymph sinus containing large pale cells, the diagnosis of which is uncertain. The nuclei when compared to those in Fig. 9, *c*, show marked similarity. *c*, carcinoma in lymph sinus. This picture should be compared to Fig. 9, *b*. *d*, carcinoma in lymph sinus. *e*, degenerating epithelial cells surrounded by lymphocytes. *f*, carcinoma. The epithelial cells are large, apparently degenerating, and contain leucocytes.



and from 1 cm. to 5 cm. in depth. Such a series of specimens, showing carcinoma in many stages, allows one to consider the accompanying degrees of lymphatic reaction. After the condition of the glands was charted the specimens and charts divided themselves into three groups. Group I contained specimens in which no carcinomatous lymphatic glandular involvement was found; in Group II there was some glandular involvement, and in Group III all of the specimens showed carcinomatous glandular involvement.

Lesions which were 9 cm. in diameter and 3 cm. in depth occurred in Group I, a fact which demonstrates that carcinomatous cells in the stomach do not always enter the lymphatic glands with the same rapidity nor at any apparent definite stage in their development.

Small ulcerations—2 cm. in diameter and 2 cm. in depth—with carcinomatous borders occasionally showed complete glandular involvement. From these figures alone it may be seen that one should not judge the condition of the lymphatics by the size of the primary lesion. There is apparently no direct relation between the size of the primary lesion and the glandular involvement. Large tumors exist without carcinomatous glandular involvement and small tumors exist with extensive carcinomatous glandular involvement. The surgeon should, therefore, be guided by the microscopic examination of regional glands. Macroscopic diagnosis, as pointed out by Lengemann,¹ Renner,² Cuneo,³ and others, has little value because glands which are grossly inflammatory often contain microscopic carcinomatous involvement.

Resected gastric specimens contained from 1 to 15 lymphatic glands,† in the lesser curvature and from 1 to 13 in the greater curvature. The average in the lesser curvature was 2.9 and the greater curvature 5.1. They varied in size from 2 mm. to 2 cm. in their long diameters and from 2 mm. to 1.5 cm. in their short diameters. Their size had no appar-

† Specimens which were removed several years ago when no attempt was made to remove all of the lymphatic glands in cases which were resected palliatively show usually a small number of glands. These cases reduce the general average in this paper.

ent relation to the size of the lesion, duration of dyspepsia, duration of acute symptoms, age, nor sex.

The 200 specimens examined contained 1404 lymphatic glands. Fifty-two per cent. of these were carcinomatous. This figure agrees almost exactly with the percentage reported by Lengemann,¹ who found 42 per cent. of 302 lymphatic glands involved, and by Renner,² who reports 50 per cent. of 78 lymphatic glands of the subpyloric group carcinomatous.

Large lymphatic glands may be inflammatory and small glands may be carcinomatous (see charts). The color, shape, size, and consistency of a lymphatic gland are not varied by the presence of one or two groups of carcinomatous cells in a sinus. Gross diagnoses are of value only in extensive involvement.

Inflammatory lymphatic hyperplasia (Figs. 8 and 9) which was found in many stages of its development in non-carcinomatous (Fig. 8) and carcinomatous (Fig. 9) glands is most important to the surgical pathologist, whose duty it is to differentiate lymphocytoblastic cells, endothelial cells, and large mononuclear lymphocytes in a hyperplastic lymphatic gland from isolated epithelial cells in the lymphatic sinuses. Differentiation for operative purposes should not be attempted by a pathologist of meagre experience. Groups of epithelial cells (Fig. 9) in the lymphatic glands should be the criterion of carcinomatous involvement. Large cells are often seen in the sinuses (Fig. 8, *d*, and *f*, and Fig. 9, *a* and *b*); some are exfoliated endothelial cells, others are doubtless macrocytes. One cannot always say that they are not epithelial cells (Fig. 9, *c*, *d*, *e* and *f*). In a lymphatic gland which is extremely hyperplastic the germinal centres present cells (lymphocytoblastic) which are variable in size and shape; these are so irregular that it is practically impossible to distinguish them from the irregular epithelial cells of carcinoma.

The cells of carcinoma are found in the peripheral or subcapsular sinuses early in lymphatic involvement, as has been previously noted by Billroth,⁹ Bozzolo,¹⁰ Rindfleisch,¹¹ Orth,¹² Zender,¹³ Petrick,¹⁴ and Cuneo.³ They may be single or in groups (Fig. 9). They may invade the tissues surrounding the sinuses. The gland may become filled with dense

connective tissue which may also become invaded. The cells occasionally penetrate the glandular capsule and invade the surrounding fat.

A detailed history of each of 200 cases would occupy more space than was intended for this paper. It must, therefore, be sufficient to briefly state their positive and negative relation to glandular involvement.

The average ages in Groups I, II, and III, are respectively 50.8 years, 51.7 years, and 46 years, which show no apparent relation between the amount of lymphatic involvement and the age of the patient when seen at operation. In the third group (extensive involvement), the average age is five years younger than the second group (partial involvement), which suggests a more rapid progress in younger individuals. The difference, however, is not sufficiently great to allow such conclusions. The extreme ages at which carcinoma of the stomach were found in this series are 30 and 83 years, a fact which adds another point to free our minds of the old clinical adage that carcinoma is a disease of middle life.

The history of gastric disturbances of a mild or intermittent nature, which have extended over a long period, may have some etiological relation to ulceration of the gastric mucosa. This feature was studied in the three groups without finding results of positive value. The duration of dyspepsia extended over average periods of 8.5 years, 8 + years and 8 + years in the three groups.

Seventy-three per cent. of all cases were in males and 27 per cent. in females, a ratio which remains practically the same in the three groups—a fact which demonstrates that sex plays no apparent rôle in influencing the amount of involvement.

Acute gastric disturbances existed in Groups I, II, and III respectively 17.2 months, 12.5 months, and 17.4 months.

A consideration of clinical facts carries with it many difficulties. Loss of weight, for example, may be due to dietary starvation, gastric secretory inactivity, gastric motor insufficiency, pyloric obstruction, or toxæmia. Whether or not one or more of these be the cause of the loss of weight in these cases, the fact remains that in Group I the average loss of

weight was 25 pounds; Group II, 28.4 pounds; Group III, 42.5 pounds. In the absence of pyloric obstruction the amount of reduction in weight may be an approximate clinical index of glandular involvement.

Another point of interest to the clinician and surgeon from a prognostic stand-point is the immediate post-operative hospital mortality in reference to the amount of glandular involvement at operation. The groups presented the following figures: Group I, 7.6 per cent.; Group II, 11.6 per cent.; Group III, 18.7 per cent. The parallel increase between the amount of glandular involvement and the hospital mortality may be indicative only of reduction of general resistance or local tissue reparative reduction in extensive carcinoma.

The subsequent mortality also varied in the different groups. The percentage of the cases which were alive one, two and three years after resection was higher in the cases without glandular involvement. Thirty-eight and four-tenths per cent. of all the cases of which some knowledge was obtained were dead.

The findings of this investigation have positive and negative value. They are, however, of greatest value in supplying the macroscopic and gross microscopic findings in a large series of specimens examined under fresh conditions at operation and confirmed by fixed tissue.

The negative conclusions may be summarized as follows:

1. The size of regional lymphatic glands bears no apparent relation to the size of the primary lesion in the stomach.
2. The size of a lymphatic gland is no criterion of the presence or absence of carcinoma.
3. Gross diagnoses of lymphatic glands are of no value except in advanced carcinoma of the glands.
4. The duration of symptoms bears no apparent relation to the size and extent of involvement in the lymphatic glands.
5. The average age at operation and sex bear no direct relation to the glandular involvement.

The positive conclusions may be summarized as follows:

1. The average loss of weight increases with the increase in extent of glandular involvement.

2. The immediate hospital post-operative mortality is in direct proportion to the amount of glandular involvement.
3. The subsequent mortality is in direct proportion to the amount of glandular involvement.
4. Carcinomatous glandular involvement is very often microscopic.
5. The surgeon who desires to treat early carcinoma must depend upon the microscope in the hands of an experienced pathologist for early carcinomatous lymphatic involvement.
6. The diagnosis of early carcinomatous involvement requires extensive experience in the study of the so-called pre-carcinomatous reaction of lymphatic glands.

LITERATURE.

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- ¹¹ Rindfleisch: Trait. d'hist. Path. Trad. franc, 1888.
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- ¹³ Zender: Über Krebsentwicklung in Lymphdrüsen, Virchow's Archiv., vol. cxix, 1890, p. 261.
- ¹⁴ Petrick: Über die Verbreitung des Carcinoms den Lymphdrüsen, Deut. Ztschr. f. Chir., Bd. xxxii, 1891, p. 530.
- ¹⁵ His: Die Anatomische Nomenclatur (Nomina Anatomica), verlag v. Veit u. Comp., 1895.

GROUP I.

Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature Involved.	Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature Involved.
16806	5	4	1	0	0	31739	3	0	3	0	0
16884	3	2	1	0	0	32018	6	0	6	0	0
17139	1	1	0	0	0	32273	10	1	9	0	0
17424	1	1	0	0	0	33109	4	0	4	0	0
17586	2	0	2	0	0	33226	10	4	6	0	0
17835	3	0	3	0	0	33255	7	1	6	0	0
18271	1	0	1	0	0	33363	11	2	9	0	0
20367	5	0	5	0	0	33621	9	2	7	0	0
20468	5	2	3	0	0	35572	3	3	0	0	0
20887	4	1	3	0	0	35590	7	2	5	0	0
21965	3	2	1	0	0	35970	3	0	3	0	0
22289	4	2	2	0	0	36489	7	2	5	0	0
22314	5	1	4	0	0	36649	10	2	8	0	0
22925	2	2	0	0	0	37070	3	3	0	0	0
23374	4	4	0	0	0	37080	6	1	5	0	0
23651	11	1	10	0	0	37265	6	2	4	0	0
24277	4	1	3	0	0	37340	8	1	7	0	0
24712	4	0	4	0	0	37392	3	2	1	0	0
24909	14	5	9	0	0	37873	3	2	1	0	0
25449	6	2	4	0	0	40013	9	3	6	0	0
26273	10	4	6	0	0	40930	6	2	4	0	0
27208	6	1	5	0	0	41081	1	0	1	0	0
27365	4	2	2	0	0	41223	7	1	6	0	0
27831	4	0	4	0	0	41511	5	5	0	0	0
28004	1	1	0	0	0	41804	3	0	3	0	0
28105	6	2	4	0	0	41966	6	1	5	0	0
28294	8	0	8	0	0	42143	9	1	8	0	0
28358	13	2	11	0	0	42151	3	2	1	0	0
29322	8	2	6	0	0	43400	7	3	4	0	0
30060	7	3	4	0	0	43698	6	2	4	0	0
30363	9	2	7	0	0	Spec. C	5	0	5	0	0
30809	6	0	6	0	0	26751	6	4	2	0	0
30824	6	4	2	0	0						

GROUP I.—DIAGRAMS OF SPECIMENS WITH NO CARCINOMATOUS GLANDULAR INVOLVEMENT. INFLAMMATORY GLANDS ARE WHITE.

CHART I.

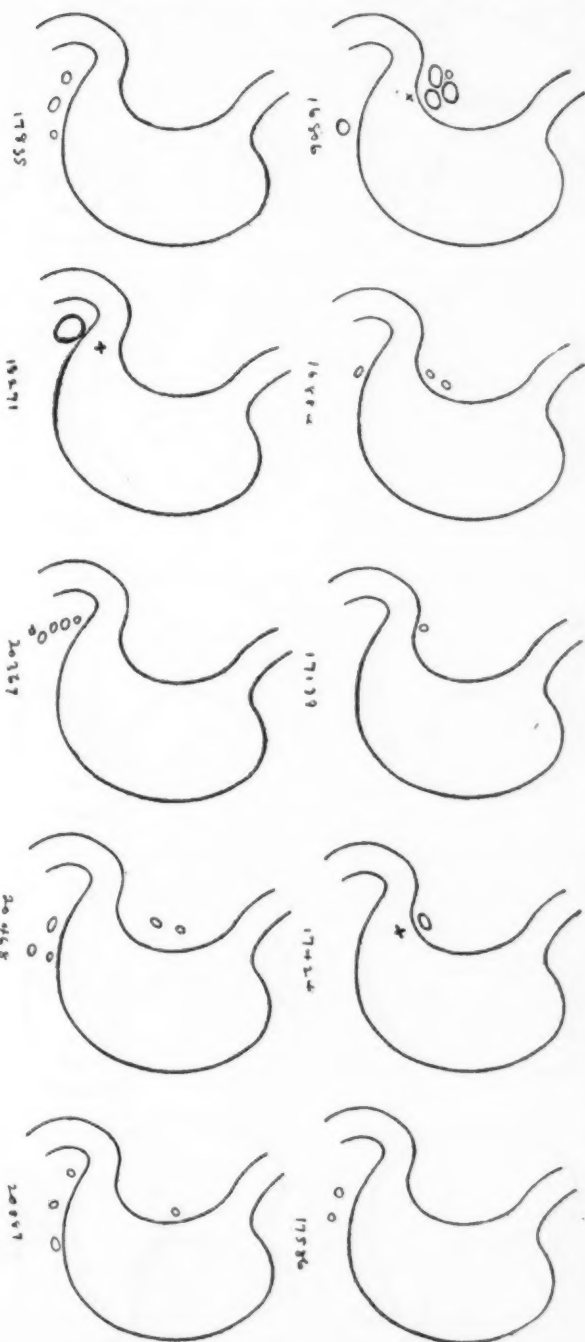
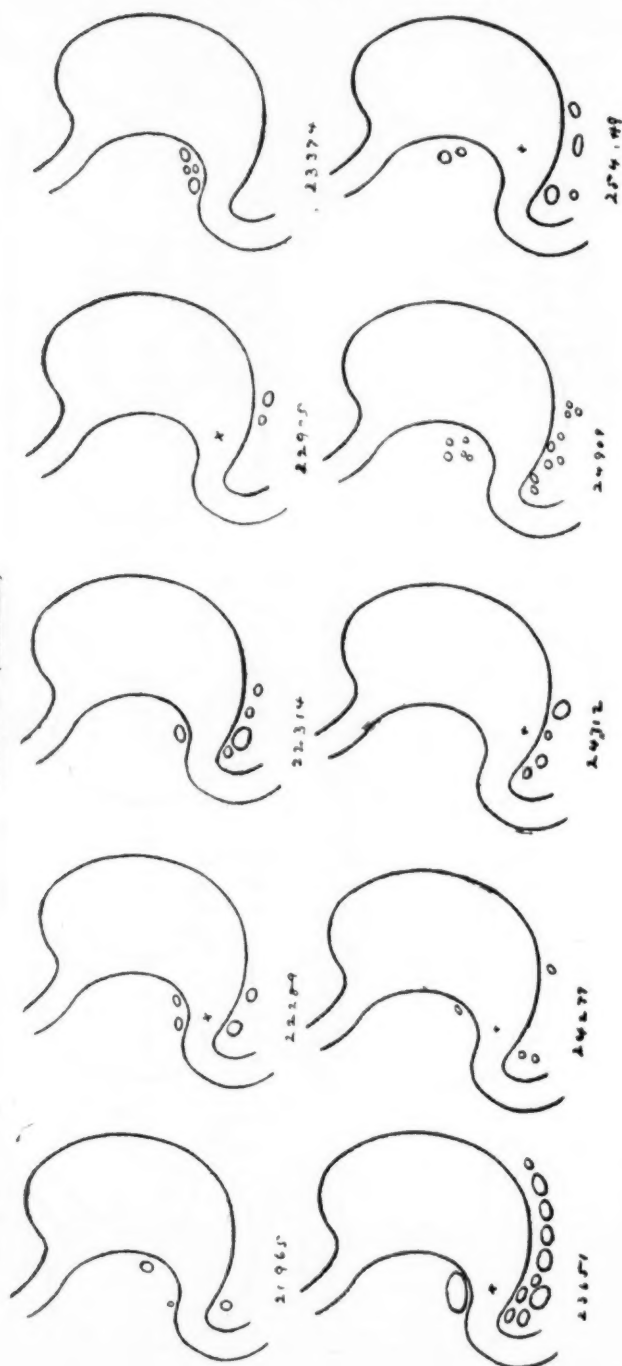
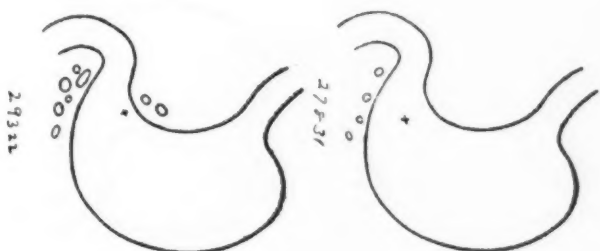
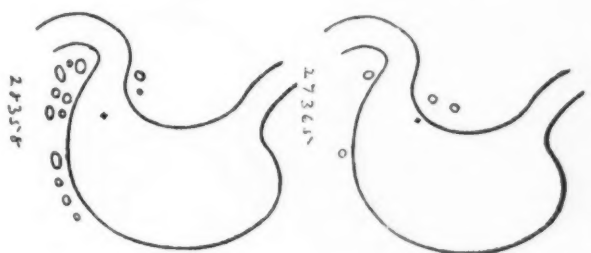
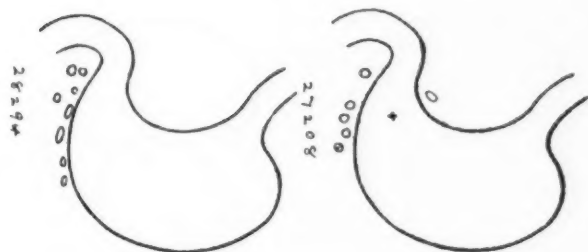
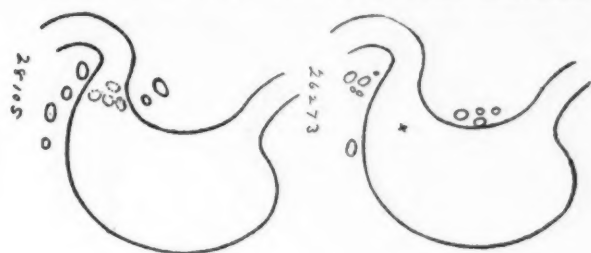


CHART I.—(Continued.)





28105

28294

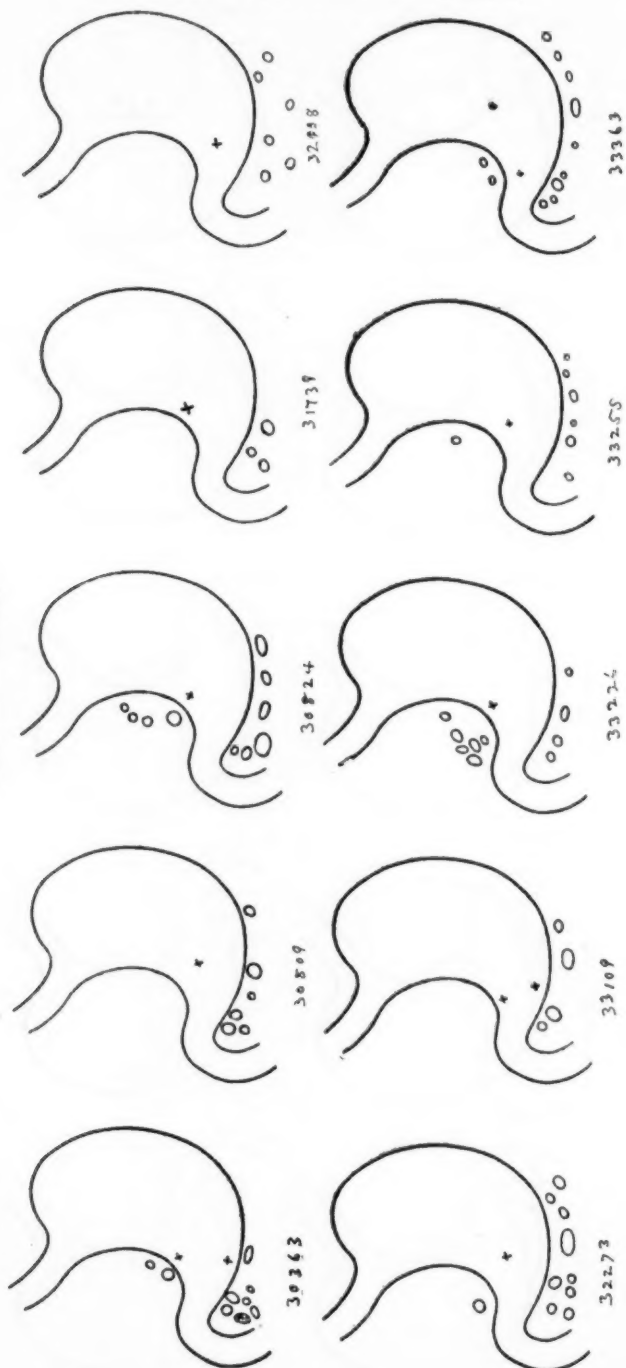
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29322

30060

CHART I.—(Continued.)

CHART I.—(Continued.)



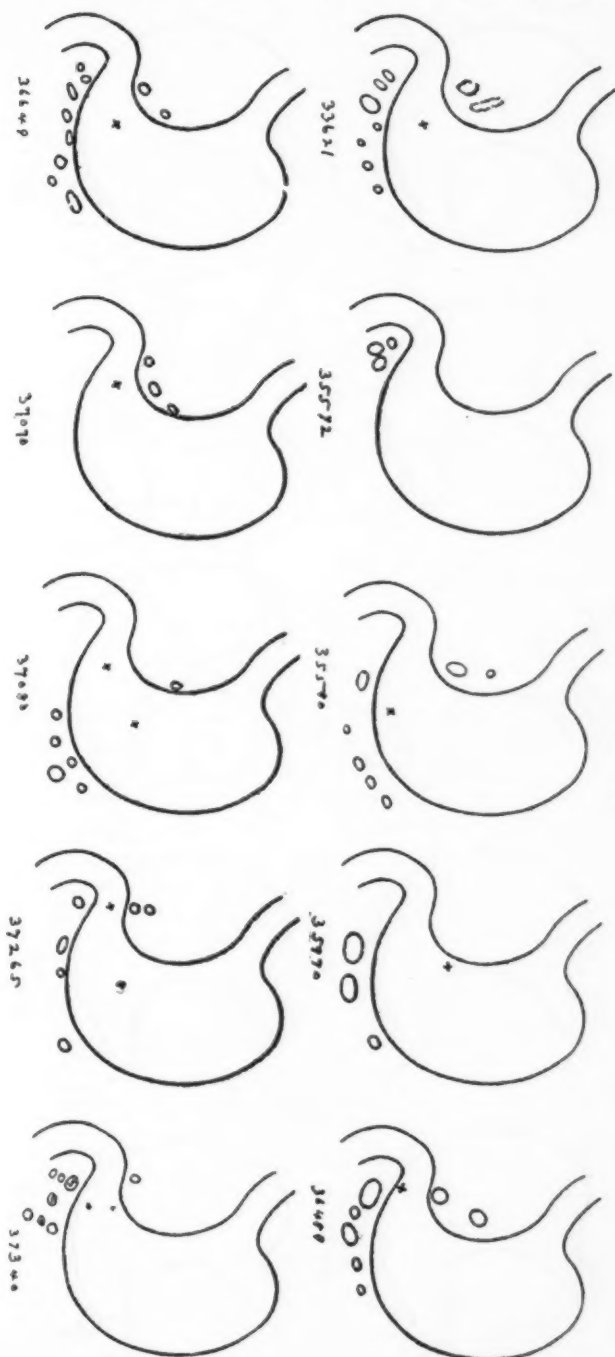


CHART I.—(Continued.)

CHART I.—(Continued.)

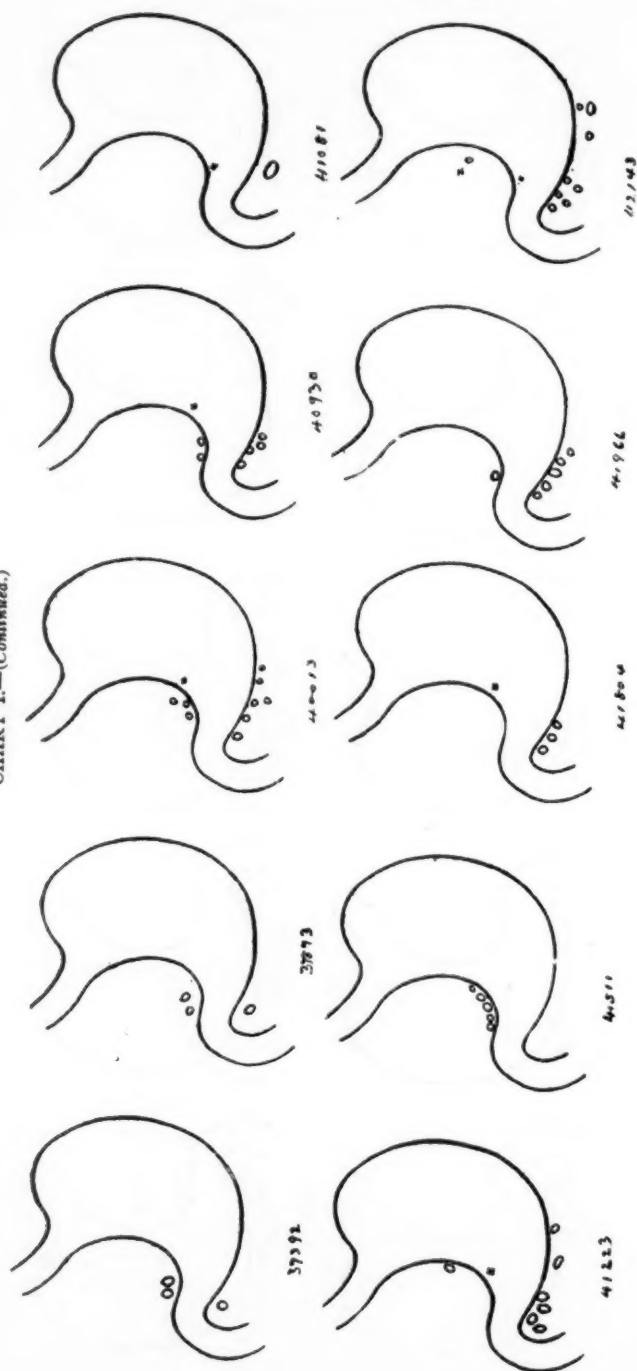
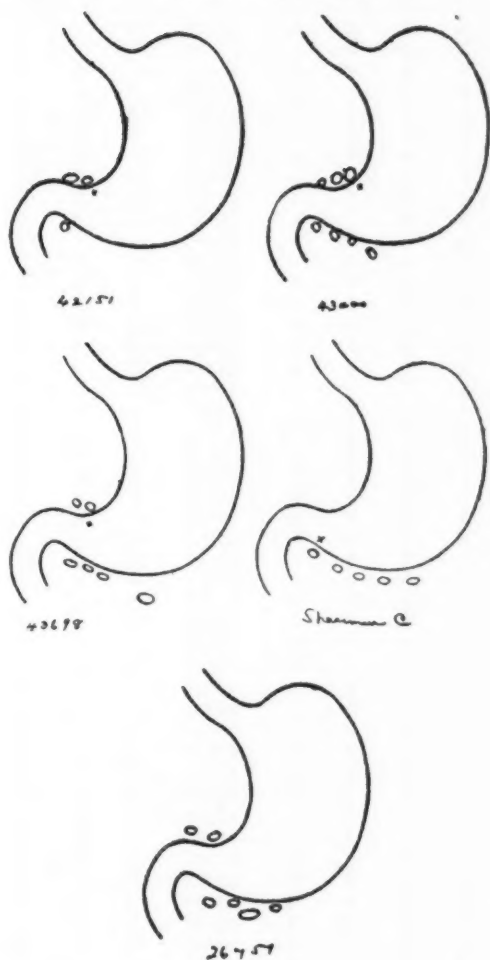


CHART I.—(Continued.)



GROUP II.

Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature Involved.	Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature Involved.
15351	6	4	2	4	1	31325	6	1	5	0	2
15673	8	3	5	0	3	31450	11	3	8	0	2
16553	6	2	4	1	3	31451	10	2	8	1	0
16729	4	0	4	0	2	31746	4	4	0	1	0
16974	7	2	5	1	5	31861	12	4	8	4	4
17319	14	3	11	3	10	31951	8	1	7	0	1
17459	8	4	4	2	2	31969	11	3	8	3	5
17985	6	1	5	0	3	32076	12	2	10	2	2
18597	11	3	8	2	4	32356	18	7	11	6	9
19070	7	2	5	1	2	32359	9	3	6	0	4
19322	8	3	5	1	3	32393	14	1	13	1	6
19376	4	2	2	1	1	32576	13	7	6	2	0
19559	4	1	3	1	2	32367	9	3	6	3	3
19604	14	6	8	2	6	33213	7	1	6	1	3
19832	2	0	2	0	1	33675	11	6	5	0	1
20442	9	4	5	2	4	33956	8	2	6	1	0
20447	9	4	5	2	4	33982	10	3	7	3	3
20623	10	3	7	2	3	33359	10	4	6	4	2
21659	4	1	3	0	1	34431	5	5	0	3	0
21803	13	4	9	3	8	34511	6	4	2	1	1
22001	6	3	3	1	0	35211	11	6	5	0	5
22047	8	1	7	1	5	35389	5	5	0	1	0
22309	10	1	9	0	6	35856	2	1	1	0	1
22973	8	1	7	0	2	36484	11	4	7	3	1
23406	8	4	4	0	1	37193	10	5	5	4	2
23612	6	0	6	0	1	37237	16	6	10	2	7
24382	8	0	8	0	3	37674	8	3	5	1	0
24527	16	3	13	0	4	37876	3	0	3	0	2
24555	9	3	6	1	0	38073	10	2	8	1	2
25550	5	2	3	2	1	38150	11	0	11	0	7
25563	13	2	11	0	8	38368	4	0	4	0	1
26043	9	3	6	2	4	38550	6	0	6	0	1
26541	5	1	4	1	3	39944	13	4	9	2	5
26743	8	3	5	3	4	40742	5	0	5	0	1
26965	8	5	3	4	2	40840	3	0	3	0	2
27209	6	3	3	3	2	41251	7	0	7	0	1
27370	5	0	5	0	2	41342	16	4	12	0	3
27559	6	2	4	1	2	42325	5	2	3	1	3
27734	5	2	3	2	0	42532	3	1	2	1	0
27898	7	3	4	3	3	42990	4	1	3	1	1
28363	9	4	5	2	0	43068	8	8	0	3	0
28189	11	3	8	1	4	43086	5	2	3	2	1
28579	10	5	5	4	4	43180	4	0	4	0	2
28880	13	5	8	5	6	43542	10	1	9	1	8
28936	13	3	10	1	7	43758	10	5	5	5	3
29239	11	5	6	5	2	43894	8	2	6	1	0
29799	8	1	7	0	4	44070	12	2	10	2	5
29904	8	1	7	0	2	44064	5	1	4	0	1
30316	11	1	10	1	4	Spec. A	13	6	7	2	7
30464	6	1	5	0	1	Spec. D	9	0	9	0	1
31140	19	5	14	1	2	42585	4 & mass	mass	4 mass	ca. 2	
31297	11	3	8	0	3						

GROUP II.—DIAGRAMS OF SPECIMENS WITH SOME CARCINOMATOUS GLANDULAR INVOLVEMENT. CARCINOMATOUS GLANDS ARE SOLID BLACK.

CHART II.

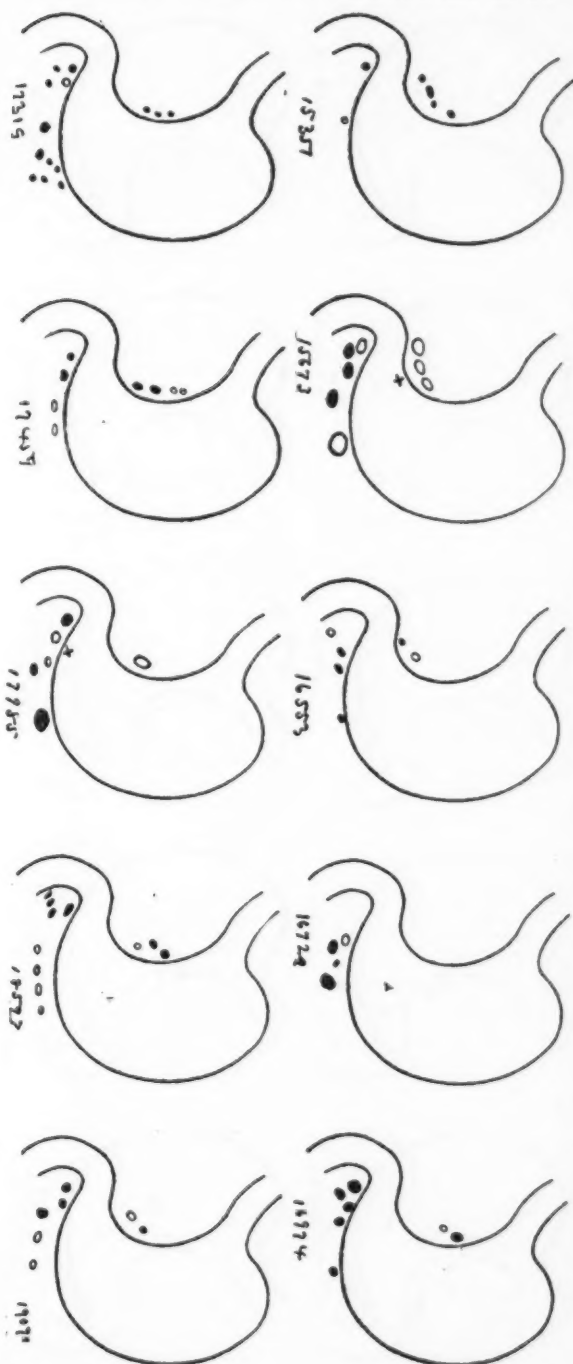
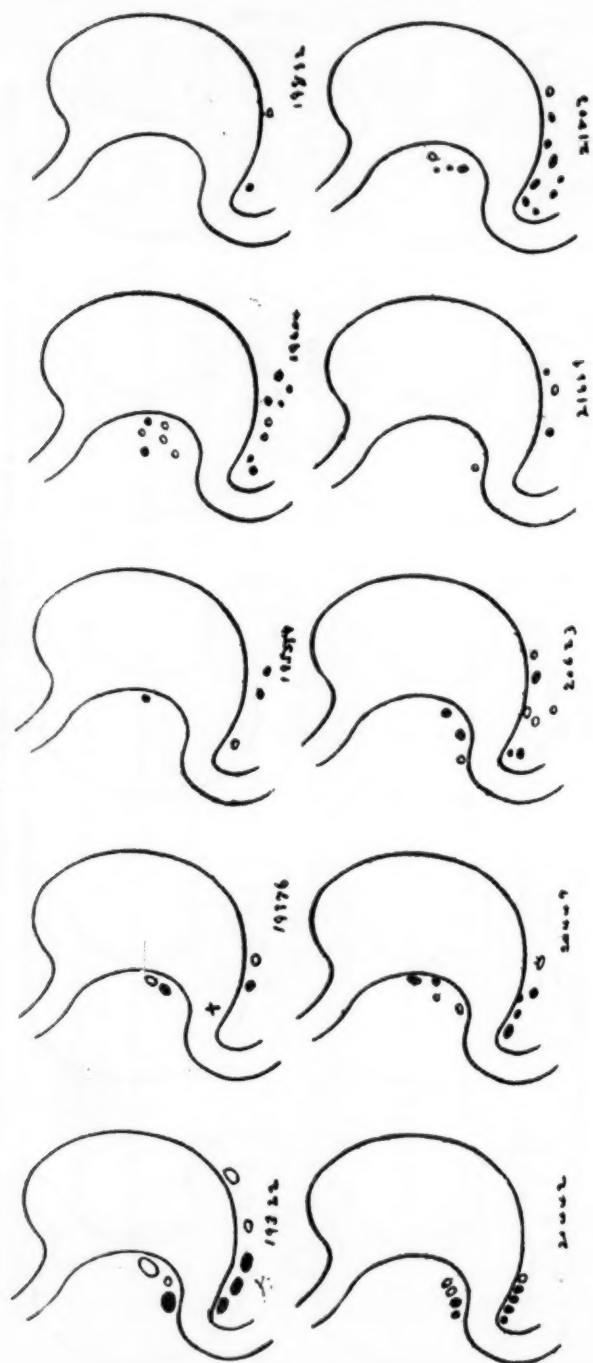


CHART II.—(Continued.)



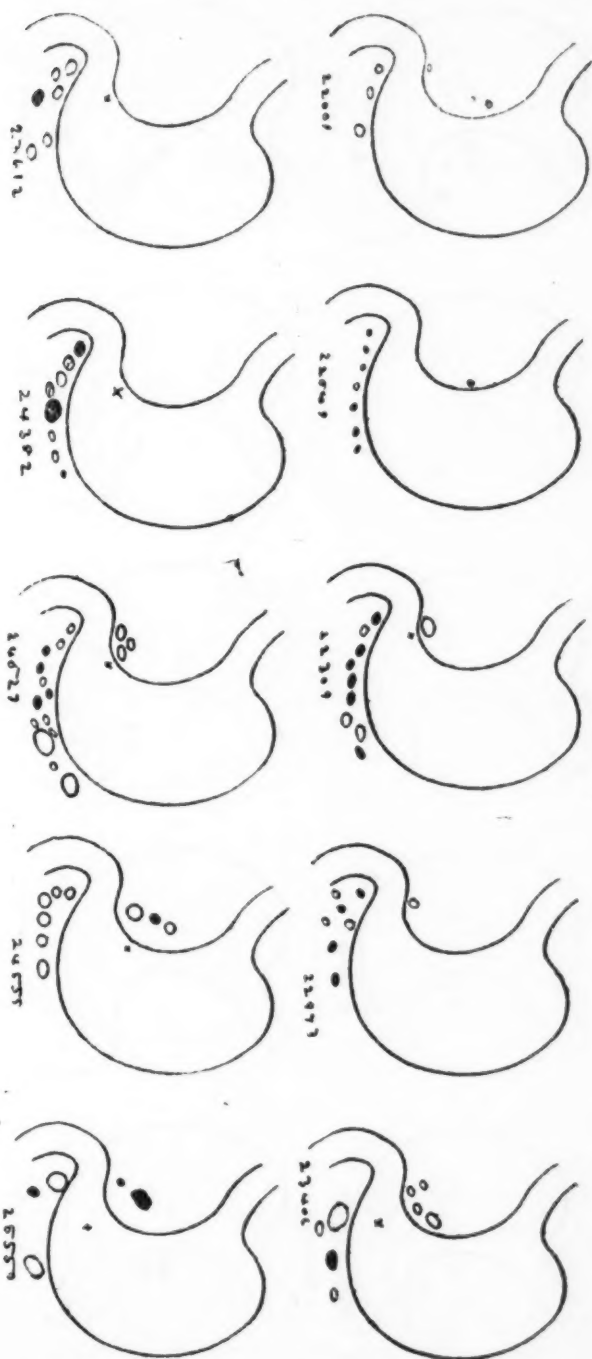
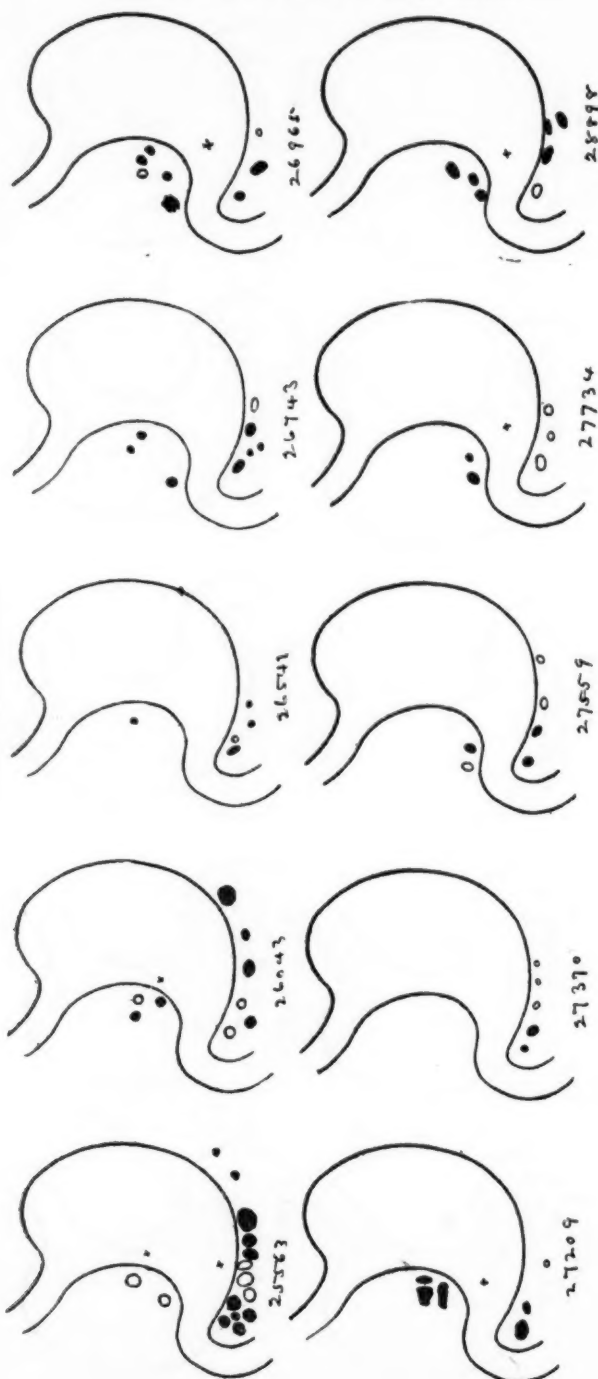


CHART II.—(Continued.)

CHART II.—(Continued.)



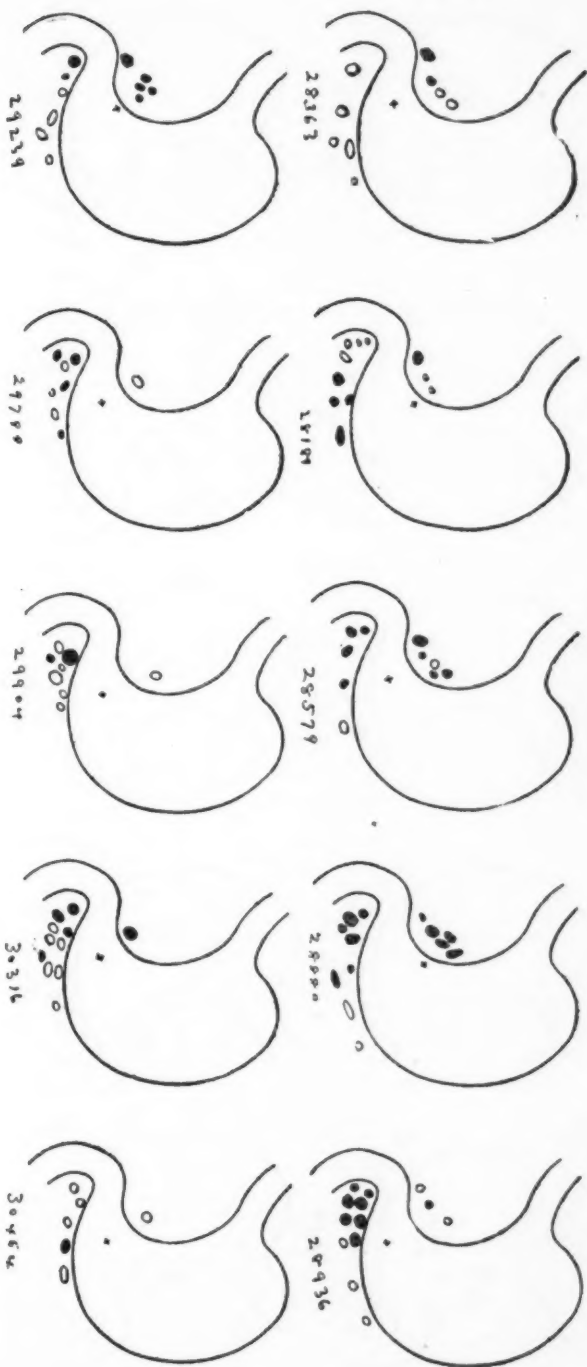
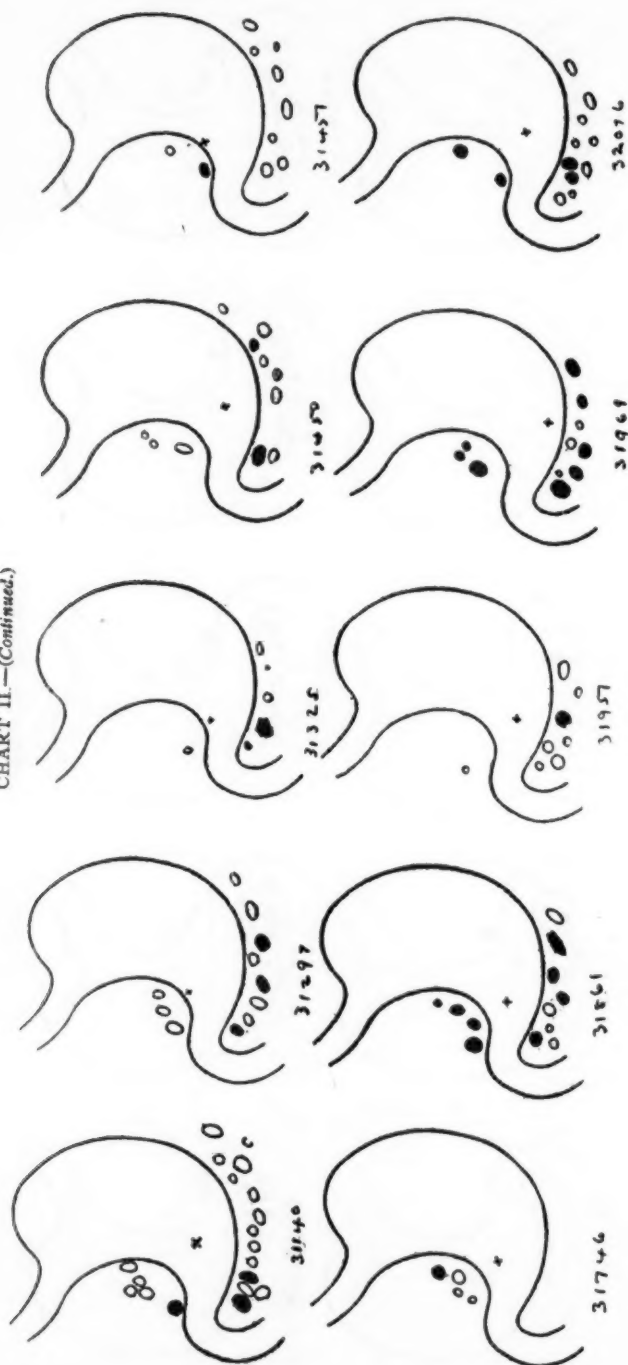


CHART II.—(Continued.)

CHART II.—(Continued.)



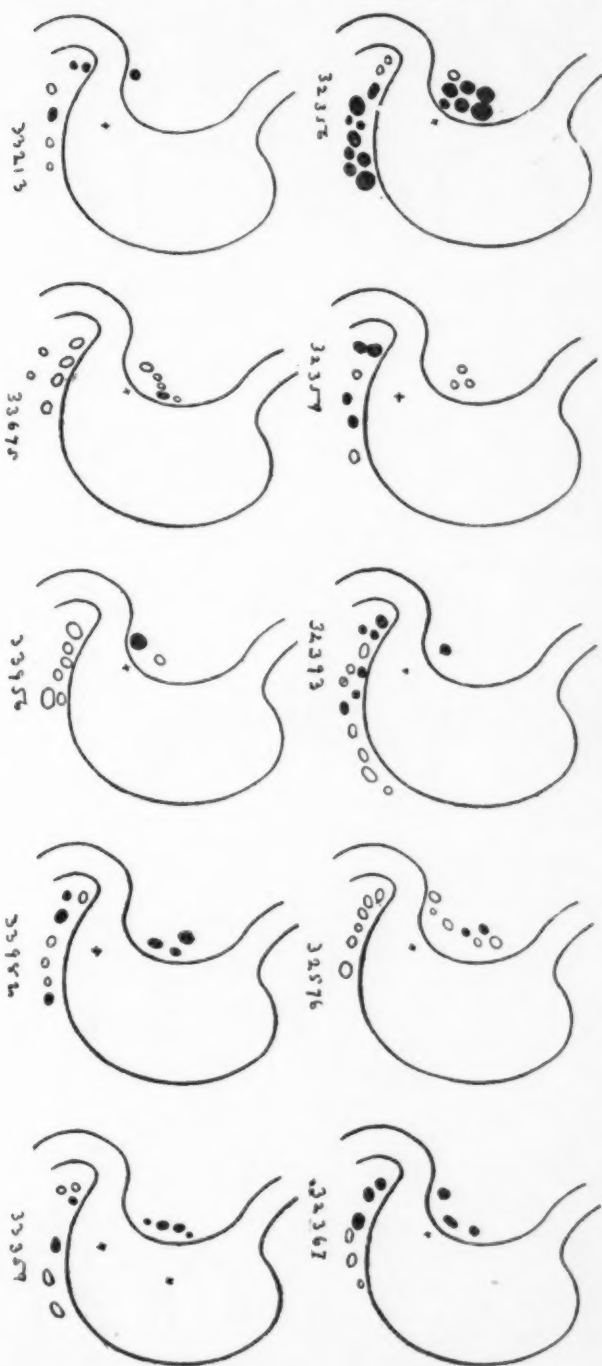
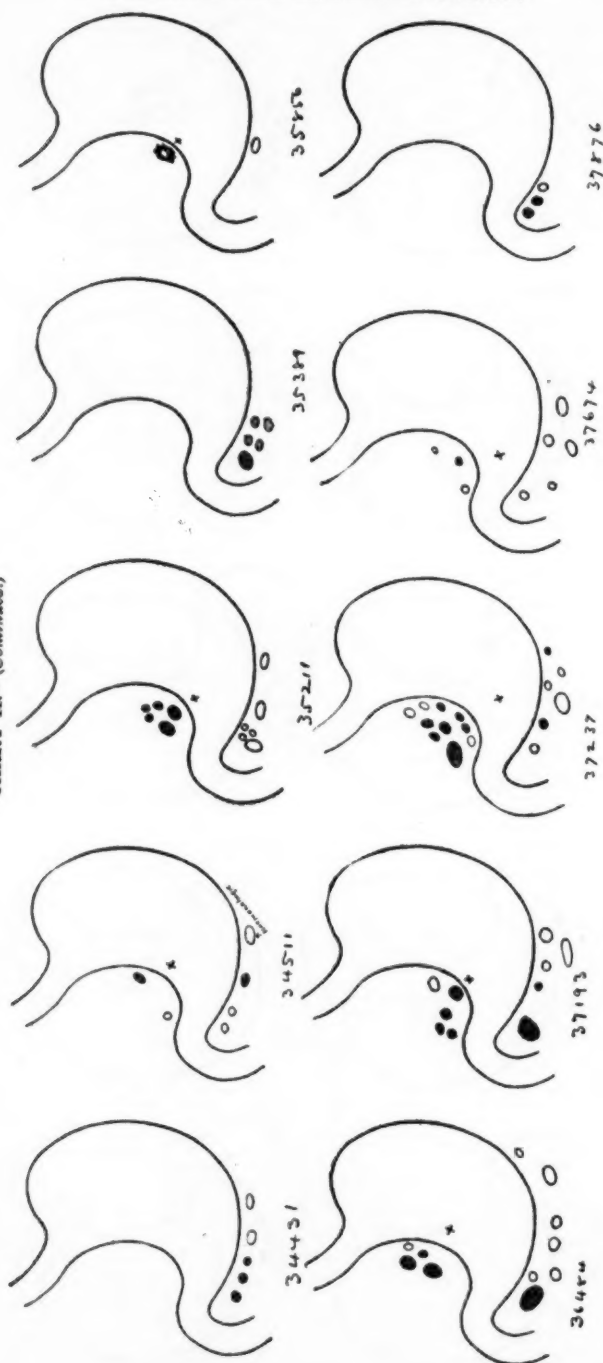


CHART II.—(Continued.)

CHART II.—(Continued.)



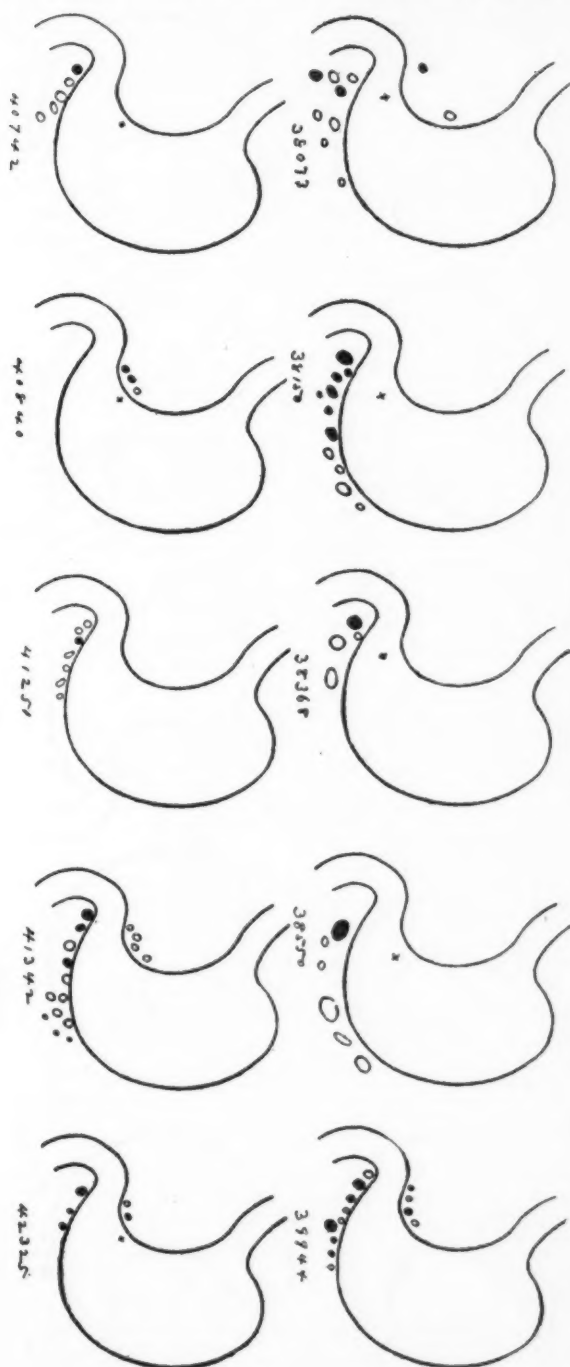


CHART II.—(Continued.)

CHART II.—(Continued.)

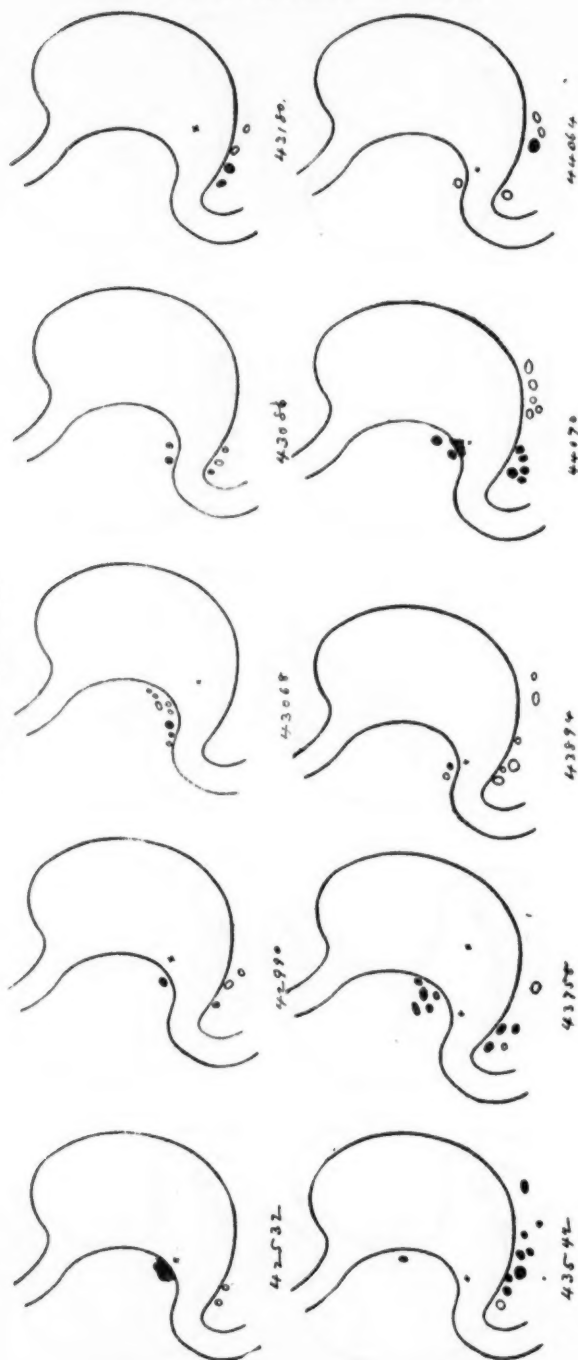
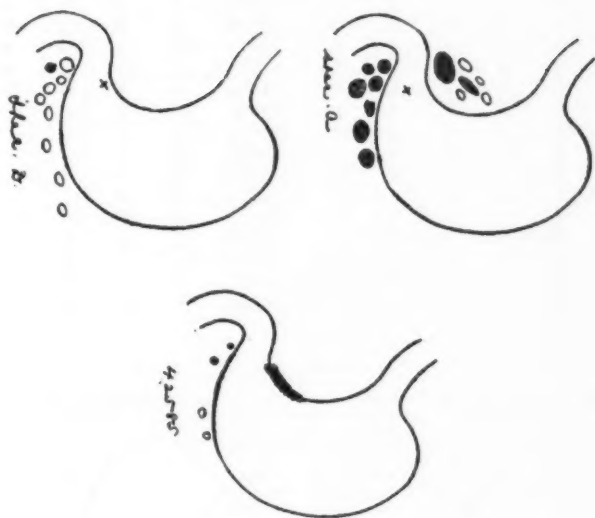


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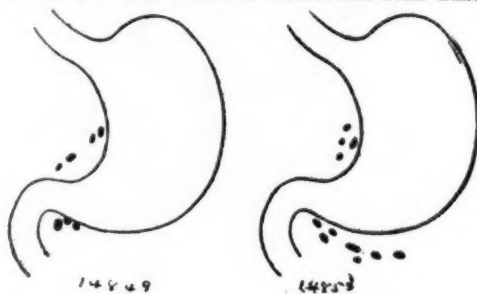


GROUP III.

Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature, Involved.	Case No.	Total No. Glands.	Total No. Glands Lesser Curvature.	Total No. Glands Greater Curvature.	Total No. Glands Lesser Curvature Involved.	Total No. Glands Greater Curvature, Involved.
14849	7	4	3	4	3	18466	9	3	6	3	6
14857	11	4	7	4	7	18468	5	2	3	2	3
14897	1	1	0	1	0	18728	4	0	4	0	4
15357	5	3	2	3	2	19574	15	5	10	5	10
15681	4	3	1	3	1	21873	3	0	3	0	3
15775	8	6	2	6	2	21882	3	0	3	0	3
16142	3	1	2	1	2	23025	5	0	5	0	5
16525	13	3	10	3	10	23654	4	1	3	1	3
16636	9	2	7	2	7	27898	3	1	2	1	2
16651	4	2	2	2	2	29402	8	0	8	0	8
16955	2	2	0	2	0	31855	6	1	5	1	5
17377	2	1	1	1	1	33445	21	15	6	15	6
17407	Esophageal glands.					33779	5	3	2	3	2
17715	8	4	4	4	4	40605	1	1	0	1	0
18088	5	2	3	2	3	41070	6	0	6	0	6
18430	5	3	2	3	2	43393	1	1	0	1	0

CHART III.

GROUP III.—DIAGRAMS OF SPECIMENS WITH TOTAL CARCINOMATOUS GLANDULAR INVOLVEMENT. CARCINOMATOUS GLANDS ARE SOLID BLACK.



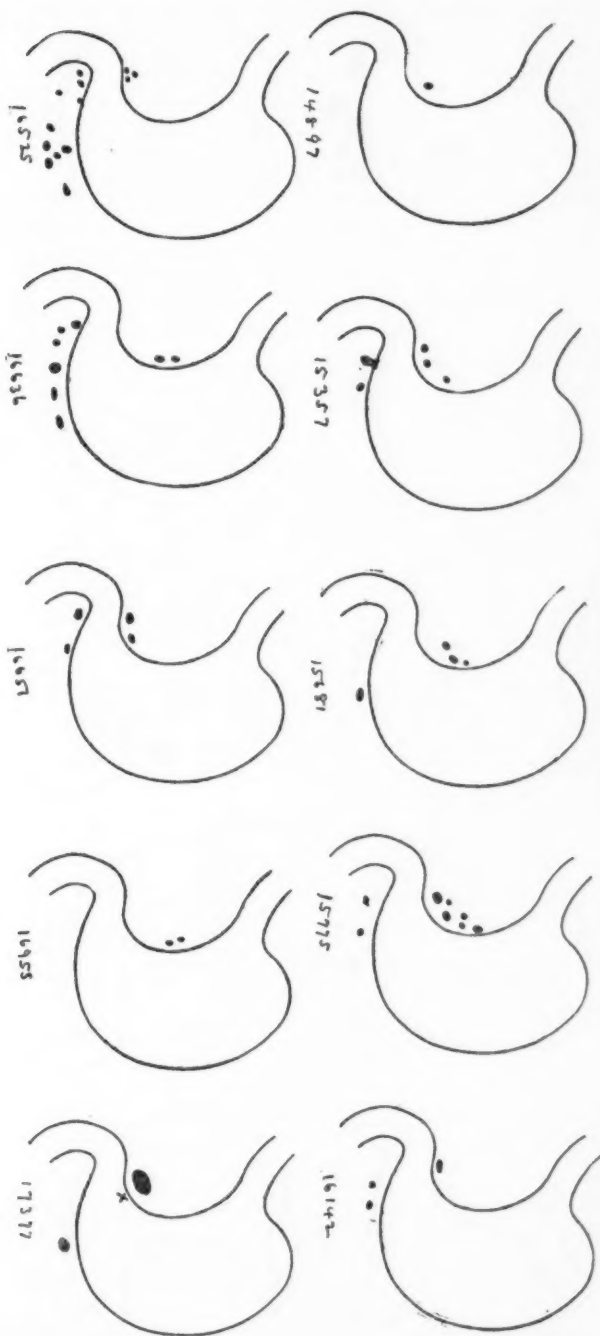
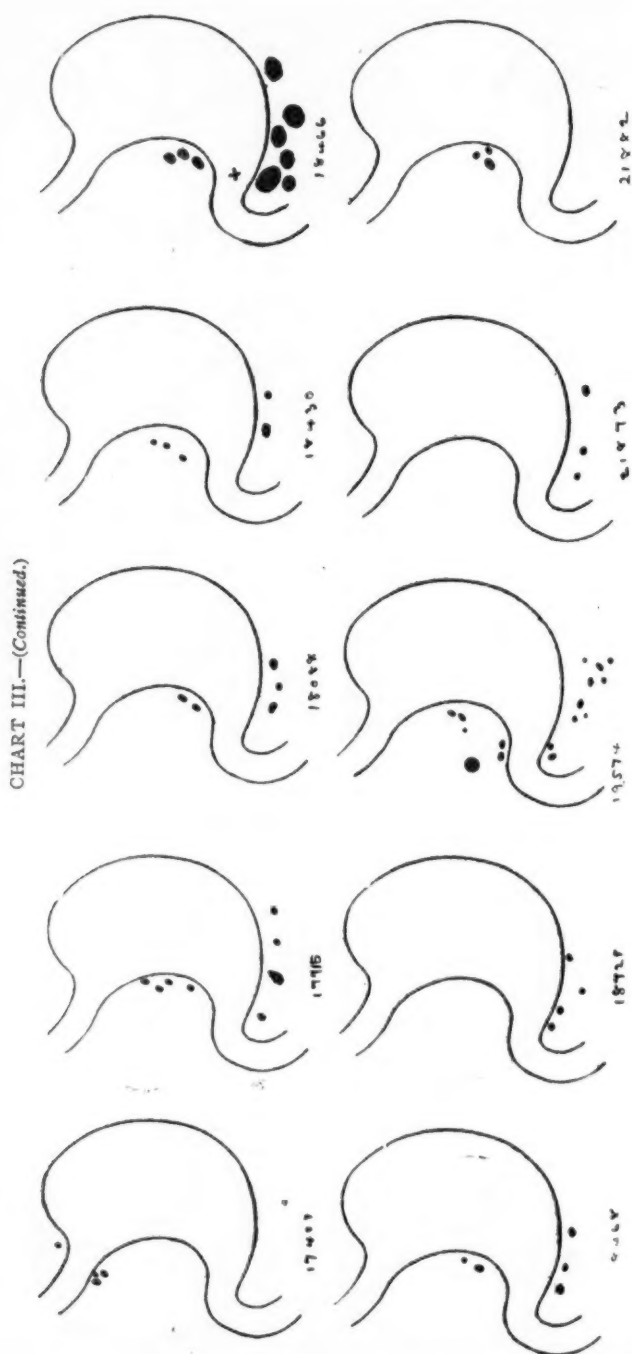


CHART III.—(Continued.)



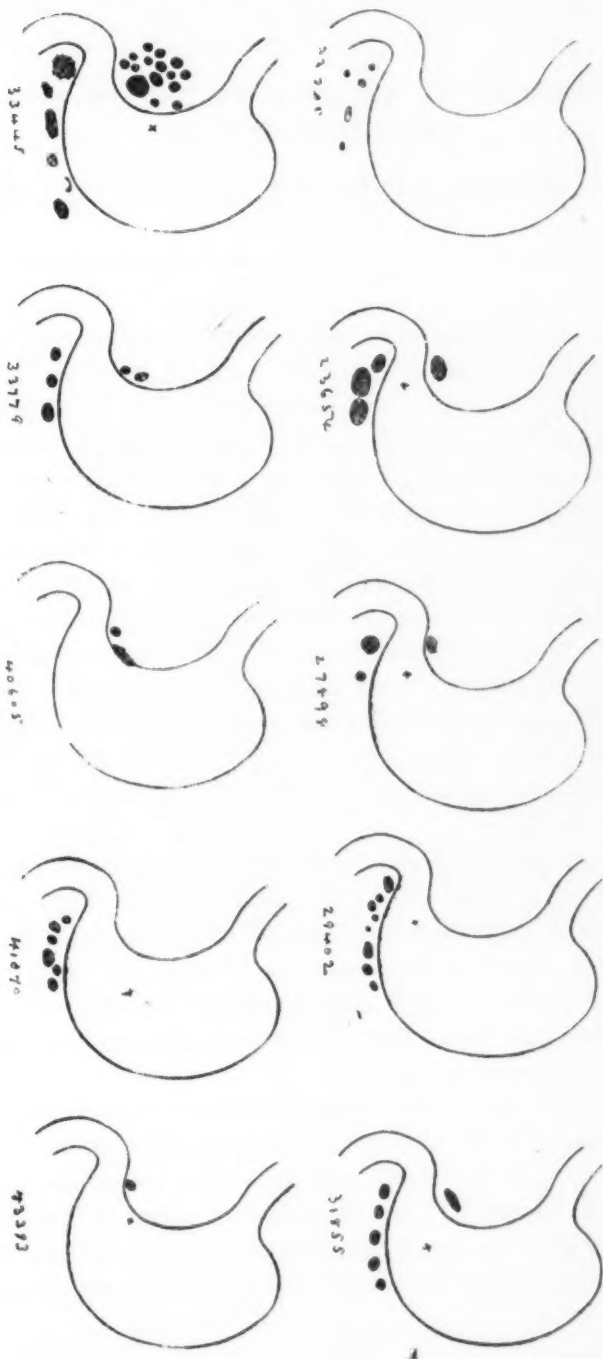


CHART III.—(Continued.)

CONGENITAL ABSENCE OF CÆCUM AND ASCENDING COLON.

BY P. LOCKHART MUMMERY, B.C.(Cantab.), F.R.C.S.(Eng.),
OF LONDON,

Senior Assistant Surgeon, St. Mark's Hospital for Diseases of the Rectum; Surgeon, Queen's
Hospital for Children.

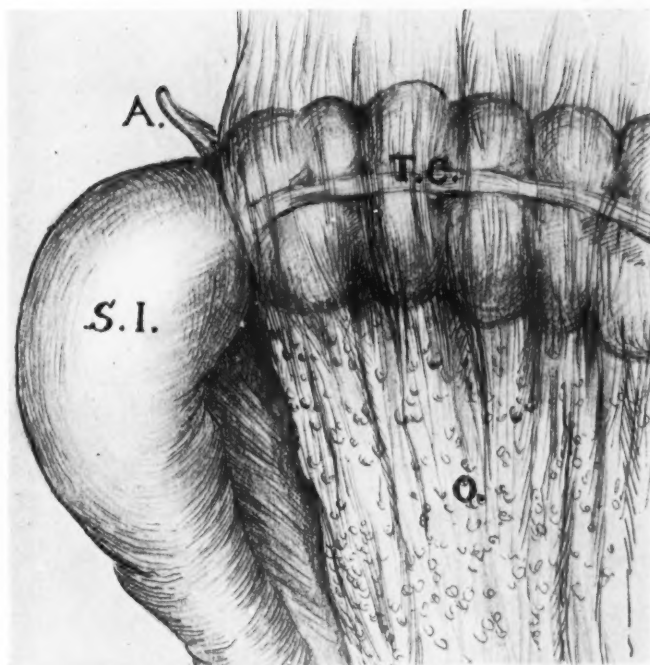
THE colon begins to be differentiated from the rest of the alimentary canal about the sixth week of intra-uterine life. The cæcum first appears as a lateral protrusion of the alimentary tube. This protrusion forms just beyond the vitelline duct, and gradually increases in size except at its blind extremity, which remains narrow and becomes the vermiform appendix. As the alimentary canal increases in length it forms a loop, the lower limb of which forms the colon, which thus comes to be placed transversely in the peritoneal cavity lying in front of the commencement of the small intestine.

In the third and fourth month of intra-uterine life the cæcum lies at about the centre of the abdomen, while the remainder of the colon lies as a curved tube in the left hypochondriac and left iliac regions, attached by a mesentery to the front of the spine.

As the alimentary canal increases in length and the loop enlarges, the cæcum and upper part of the colon are carried upward and to the left, and then over to the right, so that the cæcum comes to lie under the liver in the right hypochondriac region. At this stage the colon resembles that found in the dog, cat, and other carnivorous mammalia in which there is no ascending colon.

Later still, the cæcum passes downward toward the right iliac fossa. In the eighth month fœtus the cæcum is just below the right iliac crest, and the colon forms the typical inverted U of man. The causes of the descent of the cæcum into the right iliac fossa are somewhat uncertain, but it has been pointed out by Mr. Lockwood that in the eighth-month

FIG. 1.



Congenital absence of cæcum and ascending colon. *S.I.*, small intestine (dilated); *T.C.*, transverse colon; *O.*, omentum; *A.*, rudimentary appendix.

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1844

fœtus there is a band of peritoneum passing from the right testis to the cæcum close to the termination of the ileum, and he has suggested it as probable that the cæcum is carried down into the right iliac fossa by the descent of the testicle. Lockwood found that in the female fœtus there is a similar relationship between the right ovary and the cæcum.

The commonest congenital abnormality of the cæcum is for it to have a mesentery and be freely movable. It may have a common mesentery with the whole of the small intestine. This abnormality gives rise to the cases in which the cæcum is found on the wrong side of the abdomen, and also to cases of cæcal volvulus. A rarer condition is for the cæcum to be arrested under the liver and for there to be no ascending colon.

The subject of this note had a still more rare condition in which the cæcum and ascending colon had entirely failed to develop, the small intestine joining on directly to the right end of the transverse colon. The ileum for about four inches before its junction was considerably dilated and was apparently functioning as a cæcum. The ileocæcal valve was entirely absent, but curiously enough a rudimentary appendix existed, or possibly this was a rudimentary cæcum, just at the site of junction between the ileum and transverse colon (Fig. 1).

The patient was a woman, aged forty-two, who was admitted to St. Mark's Hospital under my care for symptoms of ulcerative colitis. For about six months she had been suffering from continuous diarrhœa, the bowels acting about ten or fifteen times daily. There was considerable abdominal pain and discomfort; the stools contained blood and pus; the patient had lost weight; the temperature was raised, varying between normal and 100°.

A sigmoidoscopic examination revealed considerable ulceration in the colon and rectum, the ulcers being shallow and tending to be discrete. It was decided to perform appendicostomy with the object of enabling the colon to be kept flushed out.

Operation.—An incision was made over the appendix, under ether. On examination no cæcum could be found in the usual situation, and it was not until the colon was traced from the centre

of the transverse colon that the abnormality was discovered. It was then seen that the lower end of the dilated ileum terminated in the right extremity of the transverse colon just beneath the liver, the two mesenteries being continuous and the right end of the transverse colon being more mobile than normally. There was no evidence of any ileocæcal valve, but at the junction a small rudimentary projection, about one inch in length and about as thick as a quill, was seen on the upper surface. The whole of the colon was studded all over with ulcers which could be felt through the walls. No evidence of old adhesions was found.

A valvular opening was made into the ileum with a No. 6 catheter, about one inch of the catheter being buried in the wall of the ileum with Lembert sutures. This portion of the ileum was then sewn to the abdominal wall and the catheter brought out through the upper end of the abdominal incision, the remainder of which was closed in the usual way.

The opening acted quite well and there was no leakage when the catheter was not in place, though it was of course necessary for a small rubber plug to be worn in the opening in order to prevent its closing.

As a result of the operation the patient did very well. The diarrhœa and bleeding ceased, and within a fortnight normal stools were being passed. The ulcers, as far as could be seen, had healed at the end of three weeks, and the patient left the hospital in good health with instructions to continue washing out the bowel once a day.

It was noted at the time of operation that although no ileo-cæcal valve existed, the ulcers were entirely confined to the colon, none being found in the small intestine. At the point of junction between the ileum and transverse colon there was a well-marked point at which the longitudinal muscle bands of the large intestine started and which corresponded to the left free edge of the great omentum. There was nothing in the patient's history or in that of her family to account for the abnormality, nor did she appear to have suffered any inconvenience from not having a cæcum, unless possibly the fact that she had got ulcerative colitis can be attributed to it, which, however, seems improbable.

Complete non-development of the cæcum and absence of the ascending colon would seem to be a very rare abnormality.

A case is recorded by Prof. Elliott Smith (*Jour. of Anatomy and Physiology*, v, 58). The patient was a woman, aged twenty-five, in whom the ileum passed insensibly into the ascending colon without there being any cæcum or any trace of an ileocæcal valve. There was no splenic or hepatic angle to the colon, and the whole large bowel was provided with a long mesentery. A rudimentary appendix was present.

A case is mentioned by Professor Turner (*Edinburgh Medical Journal*, 1863, p. 110), in which there was congenital absence of the cæcum.

Lockwood records the case of a male, aged twenty-five, in whom the colon had not completed its descent into the iliac fossa and the cæcum was situated opposite the crest of the ileum (*Brit. Med. Jour.*, 1882, vol. ii, p. 574).

H. D. Rolleston (*Transactions Path. Soc.*, 1890, p. 130) records a case of congenital maldevelopment of the cæcum. The terminal portion of the ileum had no mesentery and the cæcum was of the primitive type and had not descended, but had remained in front of the right kidney.

A specimen of retention of the cæcum in the right hypochondriac region is in the Royal College of Surgeons' Museum.

Lockwood has pointed out the very interesting fact that in the eighth-month foetus there is a band of peritoneum connecting the right testis or ovary to the termination of the ileum on the right side, and that non-descent of the cæcum is frequently associated with undescended testis or a similar condition of the ovary. Unfortunately, in my case, this was not looked for. The condition found in this patient exactly resembles that normally present in many mammals notably the cat and dog.

PREVASCULAR FEMORAL HERNIA.

BY ALEXIS V. MOSCHCOWITZ, M.D.,

OF NEW YORK,

Visiting Surgeon, Har Moriah Hospital; Associate Surgeon, Mount Sinai Hospital.

THERE are several reasons which induce me to place on record the case about to be described: (1) the exceeding rarity of this variety of femoral hernia; (2) the paucity of the anatomical description of this form of hernia; and (3) the chaotic state of the literature and nomenclature pertaining to all forms of hernia not of the classical femoral variety.

M. M., fifty years of age, a native of Roumania, was admitted to the Har Moriah Hospital, April 14, 1911. A deformity of the right foot was noted at birth, and the lame gait, which developed when he began to walk, was ascribed to that. Fifteen years ago he noticed a reducible swelling in the right groin; suspecting a rupture, he attempted to wear a truss, but this became so irksome that he soon discarded it. Gradually the hernia became larger and larger, but, with the exception of its bulk, caused him no inconvenience. After lifting a heavy weight, five days prior to his admission to the hospital, the hernia suddenly increased in size, and became irreducible. This was accompanied by sharp pain in the hernia; he vomited repeatedly, and his bowels became constipated; the constipation, however, was not absolute, as movements were obtained by the aid of high enemata.

On examination it was found that the right lower extremity is shorter by 2 to 3 cm., and slightly smaller than the left. The right foot shows a well-developed pes cavus. The right hip-joint reveals nothing abnormal, and is freely movable; X-ray is negative.

There exists a small paraumbilical hernia.

At the junction of the right thigh and abdomen, there is a large globular swelling of approximately semilunar shape. Its diameters are equal, and approximately ten inches in length. It

imparts a sensation of fluctuation, and is dull tympanitic on percussion. It is somewhat painful and very tender on pressure, particularly at the line of Poupart's ligament. The swelling is irreducible, and gives only a doubtful impulse on coughing (Fig. 1).

The attributes of this swelling were so unusual as to lead me to suspect that it was a femoral hernia, with some peculiar features. Because of its large size and the incarceration, it was impossible to determine whether we were dealing with a huge premuscular or prevascular femoral hernia.

The patient was operated upon April 14. A vertical incision, about four inches in length, was made, from Poupart's ligament downward over the most prominent part of the hernial protrusion, and the sac opened. A large amount of blood-tinged, non-odorous fluid escaped. The sac was found to contain several loops of small intestine. Their reduction was very difficult, but was finally accomplished by manipulation in Trendelenburg's posture.

The neck of the sac was elliptical in shape, and easily accommodated my four fingers, placed side by side; it extended from Gimbernat's ligament to about one inch external to the femoral artery.

The sac, much thickened and easily the size of a large coconut, was now freed from the surrounding structures and lifted upward. When this was done, a most interesting and unusual picture was revealed. All the structures of Scarpa's triangle, with the exception of the anterior crural nerve, were seen, as in a dissecting room specimen; the femoral artery and vein, naked and without their sheath, coursing downward for a distance of about four inches. No saphenous opening was made out.

The radical (?) closure of this huge ring was now proceeded with after a method described by me in the *New York State Journal of Medicine*, October, 1907. The upper end of the cutaneous incision was extended in an upward and outward direction for a distance of about five inches, and Poupart's ligament exposed. The transversalis fascia covering Hesselbach's triangle was incised parallel to Poupart's ligament, and the sac (previously liberated from below) pulled up, thereby converting the femoral hernia practically into a direct inguinal hernia. The neck of the sac was now closed by a continuous suture, and the redundant portion resected. (It is to be noted, that at no time did I come

into conflict with the deep epigastric vessels.) Poupart's ligament was now joined by four chromicized catgut sutures to Cooper's ligament; this closed off that portion of the ring extending from Gimbernat's ligament to the femoral vein. There still remained a fair sized hole, extending from the vein outward, but the closure of this was left to a later stage of the operation. The inguinal incision was now closed, as it is usually done in an inguinal hernia.

The opening, remaining to the outer side of the vessels, was closed in the following manner: Chromicized catgut sutures were passed, catching the under surface of Poupart's ligament anteriorly, and whatever fascial, muscular, and aponeurotic structures existed posteriorly, namely the psoas, iliacus, and pectineus muscles, beginning at the extreme outer end of the ring, and continuing as far as possible toward the femoral artery. This still left an opening, which was sufficiently snug to transmit without constriction the femoral artery and vein. No attempt was made to close this remaining portion of the ring; nor for that matter, do I see any possibility to do this. Closure of the skin.

I regret extremely that I did not (owing to pressure of time, the operation had already lasted an hour and a half) resect the redundant part of the skin, and this is still to be seen in the accompanying illustration (Fig. 2).

First dressing April 21. Primary union resulted and patient left the hospital seventeen days after operation.

In order to fully understand this form of hernia, a thorough knowledge of the anatomy of this region is of prime importance. I shall not review this phase of the subject in any detail. It may be of interest to relate that some of the anatomists of the last century, Hesselbach, Cloquet, and Sir Astley Cooper, have practically said the last word on the subject. There are, however, inherent to this form of hernia special points, not widely known or appreciated, which have been brought home to me in the study of my case, and to these I would invite attention.

Primarily it is important to recall, that like all great vessels of the abdomen, the iliac vessels *lie upon* the transversalis fascia and are *covered by* the peritoneum. It follows, there-

FIG. 1



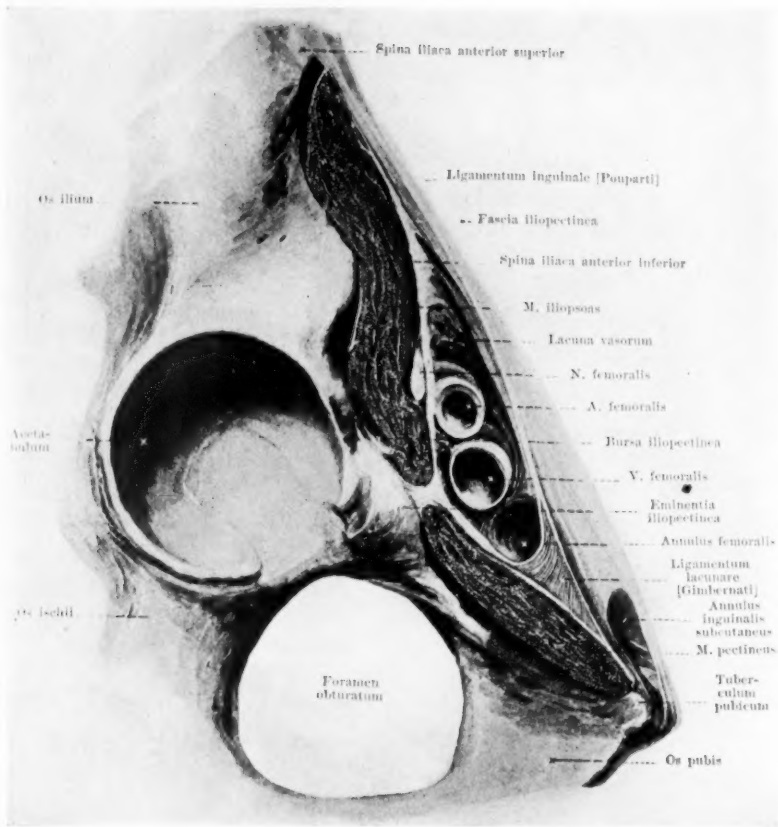
Prevascular femoral hernia, before operation.

FIG. 2.



Prevascular femoral hernia, after operation.

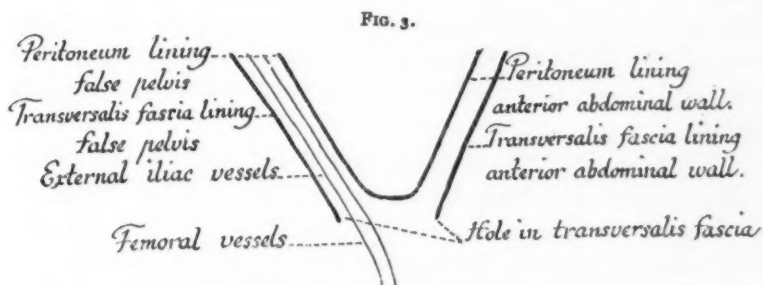
FIG. 5.



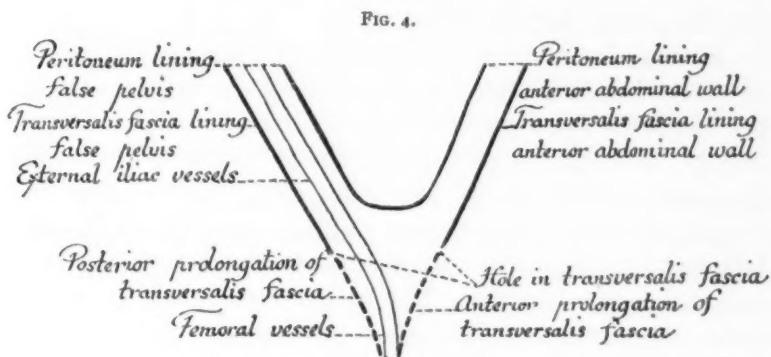
Cross-section of femoral region. (After Spalteholz.)

fore, that at that point where these vessels escape from the abdomen to the thigh, there must be an opening, or at least a weak spot in the transversalis fascia. To make this point clear, I have drawn the following diagram (Fig. 3).

This hole in the transversalis fascia, strictly speaking, does



not exist. Careful dissections have shown that the posterior or pelvic portion of the transversalis fascia is prolonged for some distance behind the vessels, while the anterior part of the transversalis fascia is prolonged for a similar distance in front of the vessels, finally both becoming blended with the vessel



wall. To be more accurate, therefore, the following would be a truer diagrammatic cross-section (Fig. 4).

This prolongation, however, is nevertheless a weak point, and constitutes an avenue for the escape of a hernia.

Fig. 5 represents a cross-section of the femoral region,

made parallel to Poupart's ligament, and is copied after Spalteholz. It is seen that the irregular space behind Poupart's ligament is divided into two halves, of which the outer one is called the lacuna muscularis, and gives passage to the iliopsoas and anterior crural nerve, while the inner one, called the lacuna vascularis, gives passage to the femoral artery and vein, leaving a practically empty compartment to the mesial side of the vein, containing only Rosenmüller's gland and lymphatic vessels, and which is the locus of the usual variety of femoral hernia.

These being the theoretical anatomical substrata of a pre-vascular femoral hernia, let me now again recall the operative findings in my case, and see in how far the actual findings of a case compare with the findings as they should be in theory.

First of all, the hernial ring was oval, of a flattened shape, extending from Gimbernat's ligament up to about an inch to the outer side of the femoral artery, easily admitting my four fingers. Now this we never see in an ordinary femoral hernia; no matter how large the hernia, the hernial ring is usually small and round, and the fascial compartment to the outer side of the ring is so dense that not even the femoral vein, much less the artery, can ever be seen.

Second, long before I proceeded with the radical cure of my case, *i.e.*, just after I had peeled off the infrapoupartian portion of the sac, I was able to demonstrate to various visitors and my assistants a perfect anatomical exposure of at least five inches of the femoral artery and vein, which showed not the slightest trace of a covering. This, to my mind, is an absolute and incontrovertible proof that we had before us a pre-vascular femoral hernia. The conventional warning, not to injure the femoral vessels when passing the sutures, is not necessary in this form of hernia. The sight of these structures is sufficient.

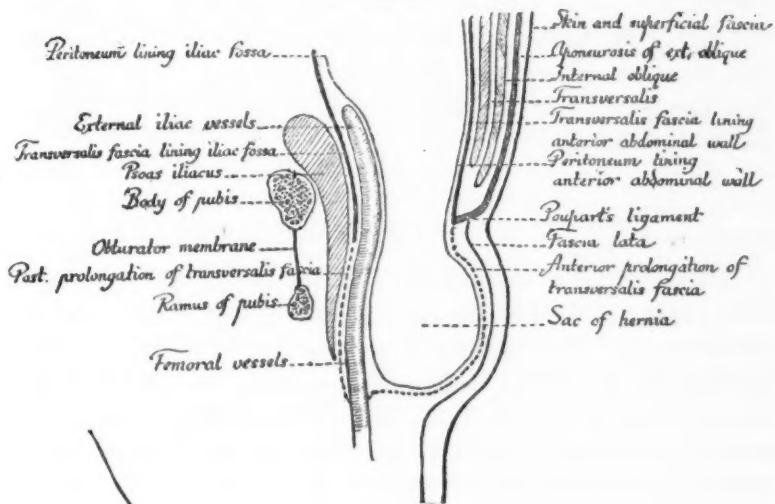
Anatomically, a cross-section of a prevascular femoral hernia can be represented by the following diagram (Fig. 6).

It is seen that the coverings of such a hernia are of the simplest, *viz.*: (1) skin and superficial fascia; (2) fascia lata;

- (3) prolongation of abdominal portion of transversalis fascia;
- (4) peritoneum.

Now all these were present and readily demonstrable during the operation. The important point to remember, however, is that the sac necessarily rests directly upon the femoral vessels. I contend that it is upon this anatomical fact, and this fact alone, so beautifully demonstrated in my case, that a diagnosis of prevascular femoral hernia can be made.

FIG. 6.



Cross-section of prevascular femoral hernia.

Deep Epigastric Artery.—The relation of the deep epigastric artery to this form of femoral hernia is of importance and interest. *Eo ipso* it is evident that the hernia, coming from above, must come into close relationship with the artery. Narath concedes this, and furthermore argues that as a part of the hernia becomes evident, even after stopping up of the femoral canal with the finger, therefore the deep epigastric artery must lie medially to the hernia.

But this is not necessarily so. The deep epigastric artery is rather tortuous in this part of its course, and lengthens or shortens itself, according to requirements. I believe the posi-

tion of the deep epigastric artery depends upon where the hernia *begins*; if the hernia originates on the outer side of the deep epigastric artery, then the artery is pushed toward the median line; if on the inner side, then the artery is pushed toward the outer side. In my case, I believe the deep epigastric artery was on the outer side, for the following reasons: that prior to deligating the neck of the sac, I made a pretty liberal incision through Hesselbach's triangle, and felt the deep epigastric artery to the outer side, but never again did I come into conflict with these vessels. While in my case the deep epigastric artery was to the outer side of the neck of the sac, I concede that in some cases it may be to the inner side. The point is that the position of the deep epigastric artery is of no diagnostic consequence.

REVIEW OF HITHERTO REPORTED CASES.

Fabricius (*Wiener klinische Wochenschrift*, 1895, p. 554): This paper was primarily intended to advocate the superior advantages of the inguinal route for the cure of ordinary femoral hernia. The case was mentioned incidentally and but very briefly. Even from the short description, however, I have no hesitancy in stating that the case was a true case of prevascular femoral hernia.

Zinner (*Deutsche Zeitschrift für Chirurgie*, vol. ciii, p. 137) reports a case of strangulated obturator hernia, which was complicated by a bilateral femoral hernia, and one of these proved on autopsy to be a prevascular femoral hernia.

In Teale's "A Practical Treatise on Hernia," London, 1846, I find the statement that Stanley met with two instances of prevascular femoral hernia in the cadaver. In each the sac was small, wide at the mouth, and empty. It passed out of the abdomen close to the femoral vessels, and was placed in front of them. I have not been able to trace this statement to its original source.

It is very surprising that in spite of the extreme rarity of this form of hernia, mention is frequently made in literature

of the possibility of such an occurrence (Pilcher, Bähr, etc.), but as far as I can ascertain, such cases were not recorded.

Conceding Stanley's two cases, our case, therefore, is the fifth, or if Stanley's cases are excluded, our case is the third, sufficiently rare, we believe, to merit a report.

These are the cases that I find recorded, and which, in contradistinction to those about to be described, may be called "spontaneous"; I refer to the six cases of Narath (*Archiv. für klinische Chirurgie*, vol. lix, p. 396): Über eine eigenartige Form von Hernia cruralis (prevascularis) im Anschlusse an die unblutige Behandlung angeborener Hüftgelenkverrenkungen.

Narath reports six cases of this form of hernia (two bilateral) after the bloodless reduction of 65 congenitally dislocated hips. It is only right to mention that considerable difficulty was met with to retain the head of the femur in the cotyloid cavity. Reluxations and anterior dislocations occurred with great frequency, requiring frequent narcoses and frequent manipulations. None of these cases were operated upon; hence exact anatomical proof is lacking. However, Narath's description is so perfect that, to my mind, there cannot be the slightest doubt that these six cases, although of a "traumatic" origin, are true cases of prevascular femoral hernia. Into this group there very probably also belongs the case published by Borchard (*Deutsche Zeit. f. Chir.*, vol. lxvi, p. 572).

My case is of especial interest, particularly in connection with Narath's contribution. The patient is lame and has a peculiar walk. This is to be accounted for by a shortening of the right lower extremity to the extent of 2 cm., slight atrophy, and by the presence of a shorter foot and a well-marked pes cavus. In view of Narath's cases, I suspected that we were also dealing with a congenital dislocation of the hip, but there is no trace of such deformity to be seen, either by examination or by X-ray. I have no doubt that the presence of the prevascular femoral hernia in this case is due in a great measure, if not wholly to the congenital deformity of the lower extremity, though it is difficult to explain satisfactorily this relationship.

DIFFERENTIAL DIAGNOSIS BETWEEN PREVASCULAR FEMORAL
HERNIA AND OTHER ABNORMAL VARIETIES OF
FEMORAL HERNIA.

Just a word or two regarding the differential diagnosis of prevascular femoral hernia and other forms of femoral hernia, in order to show what were the criteria which prompted me to accept some and exclude other cases.

1. Hesselbach's hernia passes to the outer side of the femoral artery, lying wholly in the lacuna muscularis.
2. Cloquet's hernia passes through the femoral canal to the inner side of the femoral vein; it, however, does not, like an ordinary femoral hernia, escape from the saphenous opening, but spreads out upon the pectineus, and is covered by the fascia lata.
3. Laugier's hernia escapes through a defect in Gimbernat's ligament.
4. In some articles I find mentioned a retrovascular femoral hernia. I deny, however, the possibility of such an occurrence.

As far as I could ascertain in a careful search of the literature, the case here reported is the first case of prevascular femoral hernia operated upon and studied *in vivo*.

OBSERVATIONS ON THE RADICAL CURE OF HERNIA.*

BY CHARLES F. NASSAU, M.D.,

OF PHILADELPHIA.

FEW subjects are of such perennial interest as hernia. In these days when most surgeons and even the occasional operator feel that they are protected by an indefinite fetish, by some termed aseptic by others antiseptic surgery, many patients are subjected to a so-called radical operation for the cure of hernia. Often operations seem to be performed with the idea that if the wound does not suppurate the hernia will be cured. Fortunately this is true in many cases. To operate upon a condition sometimes maiming but seldom mortal is to me a solemn procedure. How lightheartedly and carelessly many cases of hernia are subjected to operation by men who do not have even a hazy understanding of anatomy many of us know.

It is not the intention of this paper to magnify or to look upon as marvellous a properly performed operation. The mere technical and mechanical considerations entering into the surgical cleanliness and the plastic disposition of the tissues are simple. Like many simple things complications are often made artificially.

We shall confine our remarks to a consideration of inguinal hernia. Of the many operative procedures in vogue previous to the papers by Halsted and by Bassini, radical cure was a dubious outcome. To Halsted more than to any other man, we owe our knowledge of the causes of recurrence. In the exhaustive paper by Bloodgood (vol. vii of *The Johns Hopkins Hospital Report*) can be found the most careful analysis of the causes of failure and reasons for success ever published in any paper on hernia.

* Read before the Philadelphia Academy of Surgery, March 4, 1912.

As you know, Bassini transplanted the whole spermatic cord so that it made its exit at an outer and higher level, and lay between the internal oblique muscle and the aponeurosis of the external oblique muscle. It is obvious that in direct hernia and in indirect hernia with atrophy of the conjoined tendon Bassini's operation is deficient. In Halsted's early operations he laid special emphasis upon reducing the size of the spermatic cord by excision of most of the veins. The vas deferens with its artery and a few veins was left as a thin structure, and was transplanted into the upper angle of a short incision through the lower border of the internal oblique muscle; one suture was placed above the cord, including in its grasp the aponeurosis of the external oblique muscle and the internal oblique. The next suture was placed below the cord, including the internal and external oblique, a special attempt being made to draw down the internal oblique muscle in such a way that in the continuation of the suturing the so-called new canal was lined by muscle tissue. After the introduction of a single row of deep mattress sutures the thinned spermatic cord lay beneath the skin. This was the fundamental Halsted operation; it has since been much modified. The edge of the internal oblique muscle is no longer cut, and the reason is obvious when one studies the distribution of the nerve supply. As a further advance Halsted has called attention to the fact that if the veins of the cord are excised it must be done only when the vas deferens is not torn from its bed and not transplanted. The utilization of the fibres of the cremaster muscle and the overlapping of the aponeurosis of the external oblique are later developments of Halsted's method.

The operation of Ferguson of Chicago is but a wider application of the principle, that in certain cases it is not wise nor necessary to transplant or even to disturb the spermatic cord.

For the past seven and a half years, except in direct hernias and not always then, we have not transplanted the spermatic cord, unless demonstrating the typical Bassini operation to students.

It will, we think, be granted that the higher the sac is obliterated, the better. In congenital and in sliding hernia of the sigmoid the surgeon is confronted with difficulties. For more than seven years, however, in all ordinary hernias, where there has been a well-defined sac that was not too thick, and when no adhesions were present in the sac or around its internal orifice, the inversion transposition method of Kocher has always been our choice. We have called attention to these few points with a definite purpose. We have now arrived at the point where Bloodgood's transplantation of the rectus muscle can be described, and emphasis placed upon the fact that, of all improvements introduced into the operation for hernia, this, indeed, is the most valuable.

It is true that Wölfler had described a so-called transplantation of the rectus muscle at the same time or perhaps previous to Bloodgood's publication.

Wölfler opens the anterior sheath of the rectus muscle and attempts to pull the side belly of the muscle over to Poupart's ligament, with the hope of course of supplying the deficiency in the conjoined tendon. It is apparent to any one versed in the anatomy of hernia that it would be necessary to drag the muscle over the front of the remaining outer portion of its sheath and over the inner portion of the internal oblique—a process almost impossible without devitalizing tension.

Bloodgood, in his transplantation, utilizes the outer border of the rectus muscle behind the internal oblique and just in front of the peritoneum, or, as a matter of fact, the bladder. In this way the outer edge of the rectus is available for the introduction of sutures, from the point of its insertion below to a point two or three inches above. The strong, thick muscle is easily brought over the site of the direct hernia, and always three and sometimes five interrupted sutures can be used to fasten it along the inner shelf of Poupart's ligament. Any remnants of conjoined tendon can be sutured on the anterior surface of the muscle, and farther out the internal oblique and cremaster muscles can then usually be sutured to the outer half or two-thirds of Poupart's ligament without tension.

The aponeurosis of the external oblique may be closed with a continuous suture, or the aponeurosis may be overlapped by one row of mattress and one row of ordinary interrupted sutures.

Widely divergent methods of skin suture are used according to the fancy of the individual operator.

The Cause of Failure.—Primary healing is an absolute essential in the perfect cure of a hernia, although a slight degree of skin infection may cause no actual harm if the deeper structures are not involved.

We believe, however, that wound infection is probably the most frequent cause of failure. Probably the most frequent cause of wound infection is that type described by Kocher as lesion infection. Given an operating room technic of a perfection that lowers the introduction of organisms into the wound to a harmless minimum, with careful handling of the wound and clean dissection, one attains the ideal result. If, however, fingers are introduced too frequently into the wound, parts are violently retracted and tissues torn apart by rough dissection; if there is carelessness, in hæmostasis, the tissues becoming blood stained; if there is too much tension in the sutures, then we shall have the lesion infection of Kocher and Tavel, and, undoubtedly, contribute in a very marked degree toward unfavorable healing. An extremely common cause of failure is the neglect on the part of the operator to properly appreciate the best way to distribute the structures at his command.

In many individuals the arching fibres of the internal oblique and transversalis muscles are frequently deficient even where the hernia is not of the direct type. In these cases and in all direct hernias Bloodgood's transplantation of the rectus muscle must be performed, not as a matter of choice but as a matter of necessity, if the hernia is to remain cured.

Method of Rectus Transplantation.—After the ligation of the neck of the sac, a small retractor is placed under the remnants of the conjoined tendon, the pull being upward and slightly toward the median line. With the finger-tip or long

dissecting forceps, any anterior bulging of the bladder is prevented, and a longitudinal incision is made along the outer border of the rectus muscle, exposing it to a distance of from two to three inches. A traction suture is then placed so as to grasp a large part of the belly of the muscle so that it can be drawn out from its sheath over toward Poupart's ligament. Suturing is begun from below upward. Usually from three to five sutures are introduced so that the entire area occupied by a direct hernia is covered by thick muscle. Care should be taken not to introduce these sutures in the same plane along the muscle to avoid splitting it.

The next step is to bring down the internal oblique muscle to Poupart's ligament, certainly along its outer half, and if possible so as to overlap the rectus; all that remains is the suturing of the aponeurosis of the external oblique and the skin.

Choice of an Anæsthetic.—In children up to the age of sixteen or seventeen and in neurotic individuals some form of general anæsthesia is as yet the necessary evil. In young adults, in the aged, and in all strangulated hernia, except in children, we believe that general anæsthesia should be avoided as far as possible. We strongly believe that a general anæsthetic given to a case of long-standing strangulation frequently turns the scale toward death. At the present time, methods of operating under local anæsthesia, as laid down by Dr. Mitchell of Washington, are so exact and so painless, that one who has given any study to the method will no longer use ether.

A study of the article by Cushing on "The Nerve Distribution of the Inguinal Region," a little practice in infiltration and nerve blocking, together with gentleness in handling tissues, render the method one easily learned after some experience.

The infiltrating solution that has given the best results in our hands is that recommended by Mitchell. The solution is made in two strengths. The strong solution is made by dissolving a hypodermic tablet containing $\frac{3}{4}$ grain of cocaine

and 1/400 grain of adrenalin in 50 c.c. of normal salt solution. The weak solution contains the same strength tablet in 100 c.c. of salt solution. These tablets should be sterilized in very small cotton stoppered vials with dry heat, raising the temperature gradually during one hour to 100° C. Only two tablets are sterilized in each vial and they should be placed in cotton to avoid contact with glass. After experimenting with various syringes the best has been found to be the Record of 2 c.c. capacity.

The first thing to accomplish in operating under local anæsthesia is to prevent the patient from believing that anything unusual is about to take place. In fact the best way is to say very little in way of explanation. If any question is raised, let it be known that the operator is not using ether as a mark of special favor to the patient.

A few quiet words to the effect that: "We are going to operate together, and if by any chance you feel any pain let me know," will create a proper mental attitude.

The patient's general nervous sensibilities are usually less on edge if a hypodermic injection of 1/4 grain of morphine is administered a few moments before operation is begun.

Space is too limited to enter into a minute description of operation under local anæsthesia, but the points essential are: (1) Careful skin infiltration (strong solution); (2) perfect blocking of the iliohypogastric and ilio-inguinal nerves (strong solution); (3) avoiding unnecessary handling of tissues; (4) absolute prohibition as to gauze dissection; (5) forewarning patient that at this or that point some discomfort may be felt for a moment until a fresh infiltration with the weaker solution can be made.

The post-operative course of a patient operated upon under infiltration anæsthesia is so much more comfortable than with the use of ether that it is hard to institute comparisons.

The cases now reported comprise those operated upon in St. Joseph's Hospital up to May 1, 1909, at Frankford Hospital up to May 1, 1910, and at Jefferson Hospital to October 1,

1911; three operations on two patients at the Presbyterian Hospital, the last one in June, 1907.

A very large proportion of the Jefferson Hospital cases I owe to the courtesy of Dr. J. Chalmers DaCosta.

Statistical Summary.—Total number of operations, 133 on 119 patients.

Age varied from 35 days to 75 years.

There were 28 cases of strangulated hernia with 5 deaths.

One case of partial suppuration requiring removal of silk suture, result is perfect cure.

One case recurred in six months at site of transplanted cord.

Edward C., right inguinal hernia. Operation, St. Joseph's Hospital, Jan. 29, 1904. Kangaroo tendon sutures. Healing p. p. Re-operated at another hospital during my absence and was seen in September, 1904, with a second recurrence and a stitch sinus.

There were no deaths in the non-strangulated cases.

THE VALUE OF ARTERIOVENOUS ANASTOMOSIS IN GANGRENE OF THE LOWER LIMB.

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DURING the last decade the efforts of surgeons and of experimental workers have been more than ever directed to the advancement of the conservative treatment in disease—that is to say to the increase of our knowledge and capacity to replace and repair damaged tissues. The possibilities of grafting have been found to be a most fascinating and instructive study, and the satisfactory replacement of some damaged, diseased, or absent organ or structure affords the surgeon probably greater gratification than any other form of surgical success. Plastic bone and joint surgery, plastic operations for the remodelling of the face disfigured by injury or disease, the repair of damaged nerves, and the restoration of motor power and sensibility to parts previously useless, the utilization of veins for the replacement of arteries or the urethra, the reconstruction of the pharynx and mouth after extensive excisions for malignant disease, and in animals the successful transplantation of kidneys are some of the most important triumphs which have been attained in recent years.

The great and progressive diminution in the number of amputations which are done each year is also a striking testimony of the improvement in our knowledge and technic. But there are yet certain groups of cases in the treatment of which amputation is still the only certain means of saving the patient's life. Outstanding among these groups in the number of victims it claims each year is that in which gangrene is the prominent symptom.

Comparatively recently, and not so much as the result of a special effort directed against the condition as an offshoot from the vast amount of experimental work on the possibilities of surgical interference on the blood-vessels, attempts have been made to check the onset or spread of gangrene and to relieve the distressing attendant symptoms by renewing

the blood supply to the affected part. Gangrene, however, is not a disease in itself, it is but a manifestation of some pathological changes occurring in the body. Where, therefore, gangrene occurs in the course of some constitutional disturbance, such as diabetes, or as the result of some local trauma or infection, such as carbolic acid or hospital gangrene, the treatment cannot necessarily be the same as in those cases in which an obstruction of a main artery is the exciting cause. It becomes necessary, therefore, to have a clear knowledge of the etiological factors which can produce the symptom so as to be able to recognize in what cases a renewal of the circulation, if successfully effected, might arrest or even cure the gangrene.

Gangrene may occur as a symptom in various infective processes, either as the result of organisms which tend to produce gangrene as in hospital gangrene or gangrenous cellulitis, or in the course of constitutional conditions which favor the development of pyogenic organisms such as diabetes and the acute specifics. Local trauma, whether mechanical or chemical, may also produce gangrene. In by far the greater number of cases, however, gangrene is the expression of some pathological change in connection with the blood-vessels, and as it is this class of cases that most concerns us, a fuller classification of the defects in the vessels liable to produce a

CLASSIFICATION OF LESIONS OF THE CIRCULATORY SYSTEM
WHICH MAY RESULT IN GANGRENE:

- | | |
|--|--|
| (a) ARTERIAL DISEASE MAINLY:
Endarteritis obliterans (erythromelalgia).* | (c) ARTERIAL SPASM:
Ergot;
Raynaud's disease;
Frost-bite. |
| (b) ARTERIAL DISEASE AND THROMBOSIS:
Endarteritis;
Calcification;
Senile;
Bright's disease;
Syphilis. | (d) LOCAL INTERRUPTION OF ARTERY:
Embolism;
Thrombosis (post-febrile);
Injury;
Ligature. |
| | (e) ACUTE ARTERIAL DISEASE:
Acute inflammation;
Syphilis. |

* The pathology of this condition is still so obscure that it is very difficult to know whether erythromelalgia should be included in this classification, but for the purpose of discussion in regard to the treatment of it erythromelalgia is inserted under the sub-heading of "arterial disease mainly."

deficiency of circulation to the part dependent on them for nutrition may be given.

It is obvious that it is in cases of gangrene associated with only some of the diseases of the circulatory system mentioned in the above classification, and even then under certain special conditions only, that any advantage can be expected from an improvement in the circulation. Were it possible to deviate the blood from the main artery into fresh channels, so that it flows to, through, and from the capillaries in the immediate neighborhood of the gangrenous part, this would certainly tend to limit the spread of the gangrene when such was due to endarteritis obliterans, to senile or syphilitic endarteritis, or to calcification of the artery, provided always that the general state of the patient, the amount of albumin in the urine, and the presence of extensive suppuration tracking beyond the gangrene were not contraindications. Under certain circumstances it might be possible similarly to arrest or improve the gangrene developing as the result of any of the causes included under "local interruption of the artery." In embolism and thrombosis, however, the extent of the associated œdema of the part or the seriousness of the disease which was the primary cause of the vascular condition, and in injuries the extensiveness of the damage to the tissues other than the vessels, will most probably render any such operation impracticable. On the other hand, when gangrene has followed ligature for aneurism or a partial resection of the artery, the possibilities of success are very much greater, as the vessels are less likely to show marked pathological changes such as calcification which increases the technical difficulties and the risk of subsequent thrombosis.

Finally there are the two conditions, erythromelalgia and Raynaud's disease. I have not found in the literature any suggestion that the distressing phenomena which form part of the clinical picture of these diseases might be relieved by deviating the blood stream from the affected artery into the vein. Yet it seems to me that in those cases where amputation is required, either for relief of pain or on account of gangrene, and especially as in such cases also the arteries are generally

pliable, uninflamed, and uncalcified, some effort should be made to relieve the symptoms and save the limb by doing an arteriovenous anastomosis.

It was in 1902, in a case of senile gangrene, that the first attempt was made by San Martin y Satrustegui¹ to revascularize the affected foot and arrest the progress of the gangrene. He hoped that if the blood could be diverted into the vein the resistance of the valves might be overcome by the force of the stream, which could then reach the peripheral capillaries: since the arteries were obliterated by the disease, the de-oxygenated blood obviously could not be returned into the venous circulation by this route, but would have to find some other channel of return. That the arterial blood does find its way through the vein to the periphery of the limb is proved by the immediate results. Permanent success, however, has been found more difficult to obtain, owing to the subsequent obliteration of the new channel by thrombosis in the vessels or the narrowing of the arteriovenous junction. The frequency of these complications is probably due not so much to any defect in the principle of the operation as to the technical difficulties in carrying it out. In their endeavor to avoid these complications, the various surgeons who have done the operation have tried different methods of anastomosing the vein and artery, and the four methods adopted have been lateral anastomosis, end-to-end anastomosis with eversion of the intima, intubation anastomosis in which the divided central end of the artery is stitched to an oval opening cut in the side of the vein, and invagination anastomosis, the artery being drawn into the divided open end of the vein.

The numerous experiments on animals by San Martin y Satrustegui, Franz,² Carrel,³ Morel,⁴ Guthrie,⁵ and others have shown that anastomosis of vessels by the invagination method is very unsatisfactory, and that the lateral anastomosis does not give such good results as the end-to-end and the end-to-side anastomosis; their findings in the work done on animals have been very fully corroborated by the results of the operations performed on man. The clotting which occurs after the operation and which is one of the most frequent causes of

failure, may form at the junction of the vessels, at the nearest valve in the artery, or in the artery itself. Sometimes the valves in the femoral vein do not immediately give way before the arterial blood, but yield gradually within the first few hours; clotting and permanent obstruction may, however, develop before the valves have had time to yield. To render the valves incompetent, it has been suggested that a bent wire should be passed into the vein and the valves hooked and torn; such a procedure must necessarily predispose to, rather than prevent, clotting. The most serious predisposing factors to clotting are undoubtedly the bruising of the vessels specially at the line of juncture, the bruising of the surrounding tissues, the leakage of blood from the anastomosis, and finally sepsis, using the term sepsis to include not only the grosser varieties easily recognizable by the production of pus but also all minor grades however slight of infection.

When the anastomosis has been successfully accomplished and the clamps have been removed from the vessels, the vein immediately becomes dilated with blood, as far at any rate as the next valve, and pulsates like an artery. This pulsation can sometimes be felt in the veins of the leg, but its presence or absence does not necessarily imply success or failure. In the 26 cases collected by Monod and Vanvard⁶ in which the operation was done for gangrene or threatening gangrene, distention of the superficial veins of the limb was noticed four times and pulsation 12 times. In three of these latter cases the pulsation disappeared after the first few days, and the cause of this was found in one case to be the formation of a clot. The most certain indication of the success of the operation is that the foot becomes warm and the pain and cramp, usually present before the operation, diminish and disappear. If the anastomosis continues to be efficient, the advancement of the gangrenous process stops and that part already destroyed becomes marked off from the living by a line of demarcation, while the discolored areas begin to assume a more healthy appearance. But in many of the cases the new channel becomes obstructed by the formation of a clot, and the gangrene which may have been temporarily arrested

continues to spread. Yet even in some of these cases the operation has been found of great service, since it has been possible to amputate with success through the lower third of the leg and even through the foot as a result of the improvement in the circulation.

A study of these cases shows that the operation is not the unqualified success it was hoped it might be, and for this reason some authors have attempted to condemn it completely. Compared with the means previously at our disposal the operation has shown considerable advance, since not only have patients with actual gangrene recovered and enjoyed a period of relief from pain and of restoration of function for some months at any rate, but in other cases it has been possible, by doing a local amputation in addition, to obtain immunity from return of symptoms for much longer periods.

Of the 36 cases recorded, there are five in which the disease has been completely arrested for some months; in Ballance's case there was progressive improvement until the time of the patient's death from an abdominal lesion five months later; one of Tuffier's and one of Wieting's patients left the hospital with the previously diseased foot painless and serviceable; Glasstein's patient was well three months after the anastomosis, while in the author's case all symptoms disappeared, the gangrenous areas separated, and the patient has remained well and able to walk about.

To these five cases must be added two, one operated on by Satrustegui and one by Wieting, in which in addition to the anastomosis a strictly local amputation of the toe or foot was done. The result of both was perfectly satisfactory.

It must be remembered that the number of patients on whom the operation of arteriovenous anastomosis for gangrene has been done is small and that greater experience is required to determine the choice of case and of technic. The operation is not an easy one, and the technic employed for controlling the hemorrhage and for uniting the vessels has varied greatly. There is no doubt that many of the cases operated on were not suitable on account either of the state of the gangrenous part, the extent of the thrombosis, the advanced age, or the

bad condition of the patient. Two instances may be given. In Imbert's case the patient died two days after the operation from cachexia; in one of Mauclaire's cases the patient was 72 years of age, and the artery was found to be filled with clot at the point of section and a probe was passed up into the external iliac in the attempt to clear the lumen of the artery.

Wieting, after whom the operation is usually called in Germany, although San Martin y Satrustegui was the first surgeon to perform arteriovenous anastomosis for gangrene in man, has laid down very clearly the indications for the operation. They are as follows:

TABLE OF CASES OF ACTUAL GANGRENE OF THE FOOT TREATED BY ARTERIOVENOUS ANASTOMOSIS.

Name of Surgeon	Sex	Age	Type of anastomosis	Result
San Martin y Satrustegui ¹	M.	52	Lateral. Combined with amputation of gangrenous part of foot	Immediate result good, but on 6th day reappearance of pain. Amputation at seat of election and latter through thigh. Death on the 13th day.
San Martin y Satrustegui ¹	M.	76	Lateral. Combined with Syme's amputation	Disappearance of pain. Patient discharged cured.
Hubbard ⁷	M.	80	End-to-end. Invagination of artery	Gangrene spread over foot and then line of demarcation formed. Pulsation in saphenous vein below anastomosis. A month later amputation at seat of election. Tibial arteries found to contain arterial blood.
Hubbard ⁸	F.	60	End-to-end. Invagination of artery	Spread of gangrene. Amputation through thigh 10 days later. Anastomosed vessels found filled with loose clot.
Hubbard ⁹	F.	84	End-to-end	Limb became warm and slightly oedematous. One month later spread of gangrene and death 2 months after operation.
Lilienthal ¹⁰	M.	20	End-to-end	Marked post-operative collapse and death 31 hours after the operation.
Tuffier ¹¹	M.	56	Lateral	No improvement; death on the 8th day.
Tuffier ¹²	M.	50	End-to-end	Pulsation of veins over instep for first 2 days after operation. Disappearance of pulsation thought to be due to thrombosis from slight wound infection. Patient left hospital in a satisfactory condition.
Ballance ¹³	F.	75	End-to-end	Pulsation felt same evening in dorsal veins of foot and internal saphenous. Line of demarcation of gangrene and no return of symptoms. Death 5 months after from acute gangrene of intestines. Complete cicatrication of anastomosis found post mortem.

Name of Surgeon	Sex	Age	Type of anastomosis	Result
Orhan ¹⁴			End-to-side. Intubation of artery	Spread of gangrene; later line of demarcation between middle and upper third of leg. Amputation. Recent thrombosis of popliteal vein found.
Jaboulay ¹⁶	M.	47	End-to-end	Slight improvement, but amputation through lower third of leg 7 days later on account of pain and rise of temperature. No bleeding from arteries; thrombosis of internal saphenous vein. Pulmonary embolus and death 19 days after first operation.
Jaboulay ¹⁸	M.	66	End-to-end	Spread of gangrene necessitating amputation above site of anastomosis on 5th day. Anastomosis contracted but permeable.
Jaboulay ¹⁸	M.	67	End-to-end	Spread of gangrene and amputation 4 days later. Death on 6th day. Femoral vein found obliterated by clot which extended up into central end of artery.
Lund ¹⁷	M.	32	End-to-end	No improvement. Amputation through foot and later at seat of election.
Armour and Smith ¹⁸	M.	69	End-to-end	General improvement; line of demarcation on 4th day. On 14th day amputation above knee. The vein pulsated at the point of division in the flap, but the artery was occluded.
Abalos ¹⁹	M.	62	Lateral, between femoral artery and saphenous vein	Loss of pain and improvement for 10 days. Pulsation in internal saphenous vein. Then exacerbation of gangrene and amputation through upper third of thigh. Femoral artery and saphenous vein filled with clot.
Imbert ²⁰	M.		End-to-side. Intubation of saphenous vein into side of femoral artery	Two days later death from cachexia. Anastomosis examined, opening small but patent.
Celesia ²¹	F.	52	Lateral	Pulsation in veins below anastomosis on same day, but none the following day. General improvement of foot. On 6th day slight suppuration in wound. Pain in hip on 9th day; abscess opened on 22d day, followed by death. Anastomosis found to be patent.
Tietze ²²	F.	69	End-to-side. Invagination of artery	Spread of gangrene and death from cachexia. The artery was found to be narrowed and the vein thrombosed.
Goldenberg ²³	M.	64	End-to-side. Invagination of artery	General improvement. Reappearance of pulsation in popliteal space, but death from erysipelas on 15th day.
Schmieden ²⁴	F.	48	End-to-end	Return of color to foot, but death next day from heart-failure.
Muller ²⁵	M.	51	End-to-end	Spread of gangrene and appearance of line of demarcation on 3rd day. Amputation refused at first, but done 6 weeks later. Posterior tibial and peroneal veins showed slight spurts of blood; arteries thrombosed. Death 8 weeks after anastomosis.

Name of Surgeon	Sex	Age	Type of anastomosis	Result
Enderlien ²⁶			End-to-end	Circulation restored temporarily, then spread of gangrene and amputation. Artery and vein extensively thrombosed.
Enderlien ²⁶			End-to-end	Improvement during the first 24 hours, but death on the 3rd day. Extensive thrombosis of vein.
Krüger ²⁷	F.	48	End-to-side. Intubation of artery	Spread of gangrene. Pirogoff's amputation on 10th day and Gritti's on 18th. Both artery and vein thrombosed.
Payr ²⁸	M.	70	End-to-side. Intubation of artery	Good result for 10 days, then spread of gangrene and death on 16th day from heart-failure and cedema of the lungs.
Coenen and Wiewiorski ²⁹	M.	51	End-to-end	During operation clot found in femoral artery and removed. Spread of gangrene. Amputation through middle of thigh.
Mauclair ³⁰	F.	73	End-to-end	No improvement. Amputation at seat of election on 8th day. Amputation through thigh a fortnight later followed by death from cachexia.
Mauclair ³⁰	M.	72	End-to-end	Artery filled with clot at point of section. Probe passed into external iliac in attempt to dislodge clot, but blood only trickled through artery; anastomosis, however, done. Death on 8th day.
Krause (Quénu) ³¹ ..			End-to-end	Progress of gangrene. Amputation at seat of election 4 months later; blood spurted from tibial vein. Internal saphenous vein injected; injection spread to limits of gangrene; behind the internal malleolus a tributary of the posterior tibial vein joining the internal saphenous was well injected. The anterior and posterior tibial arteries and the peroneal were not injected.
Orhan ³²	M.	40	End-to-side. Intubation of artery. Combined with Chopart's amputation	Healing slow, amputation through lower third of leg.
Wieting ³³	M.	33	Lateral. Combined with removal of gangrenous toe	Improvement slow. Erysipelas 11 weeks after operation necessitating disarticulation through knee-joint.
Wieting ³³	M.	32	Lateral	The gangrene in this case was of a very chronic nature and the 4th toe had already separated, leaving a gangrenous stump. Discharged healed in 5 weeks.
Wieting ³³	M.	35	End-to-side. Intubation of artery	Chopart's amputation necessary 24 hours later; wound healthy and healing on 14th day.
Glasstein ³⁴	M.	38	End-to-end	Patient left the hospital 3 months later. The gangrene and pain had disappeared and the limb was a good color.
Morrison Davies.	M.	46	End-to-end	Disappearance of gangrene and return of warmth and natural color to the foot with complete freedom from pain. Patient commenced walking on the 28th day and left the hospital at the end of the 8th week. Four months later he was still quite well.

* At the end of the same year Wieting did an arteriovenous anastomosis on the opposite lower limb of this patient for threatening gangrene of the foot.

All other forms of conservative treatment must have been attempted first. The condition of nutrition of the patient must be good. Infection, if present, must not be extensive. Oedema must readily subside on raising the foot so as to prove that the venous circulation is sound. The most favorable cases are those in which the gangrene is only threatening. Pulsation must necessarily be present in the femoral artery, and the femoral vein must be free from thrombosis.³⁴

Wieting has himself done the operation five times: three times for actual and twice for threatening gangrene. In one case high amputation was necessary owing to the development of erysipelas nearly 11 weeks after the anastomosis, and in another case Chopart's amputation was done. The remaining three patients were discharged greatly improved—a striking testimony of the value of the operation in properly selected cases.

AUTHOR'S CASE.—The patient is a man aged forty-six, a publican. He has had syphilis and has been a free drinker.

He had suffered from pain and had noticed the progressive discoloration of the middle toe of the left foot since March, 1911.

His condition on admission to the hospital on June 21, 1911, was as follows: The terminal half of the middle toe of the left foot was black and shrivelled, and was marked off from the more healthy tissues by a commencing line of demarcation. No pulsation could be felt in the anterior or posterior tibial or popliteal arteries on either side. Immediately after admission the patient had an attack of delirium tremens.

On July 3, the gangrenous toe was removed by a circular incision round the base; the wound was plugged and left open.

At the beginning of August, when the patient came under my care, the wound was healing but the foot was cold and painful, and there were areas of bluish-red discoloration on the dorsum. By August 13 two small patches of gangrene had developed on the foot, one on the outer side of the second and one on the inner side of the fourth toe. The discoloration of the foot had increased, while the whole of the great toe and adjoining part of the foot, and the skin over the fifth metatarsal

and over the dorsum were dark bluish-grey with red patches. The amputation wound was granulating slowly.

The femoral artery was easily felt pulsating in Scarpa's triangle, but no pulsation could be made out elsewhere in the limb. The right foot was cold but not painful, and the condition of the vessels on this side was the same as on the left.

There was some hypertrophy of the heart, a trace of albumin in the urine, and the blood-pressure was 220 mm. of mercury.

Both lower limbs were rendered bloodless by elastic bandages; on removing these after a few minutes the reactive hyperæmia was very slight and on neither side spread more than four inches below the knee.

Operation August 15, 1911: Incision five inches long over the sartorius muscle of the left thigh, the mid-point of the incision corresponding to the apex of Scarpa's triangle. The sartorius muscle was drawn outward and the fascia over Hunter's canal divided. The superficial femoral artery and vein were exposed for a length of three inches, dissected free from each other and from the surrounding tissues. Only one small branch of the artery and one tributary of the vein had to be divided. A clamp protected by rubber tubing was placed on the central end of the artery and another on the distal end of the vein; the central end of the vein and the distal end of the artery were ligatured. The artery and vein were then cut across at right angles to the lumen, but the point of section of the artery was 1.5 cm. lower than that of the vein so as to ensure the complete absence of all tension on the vessels when united. The cut section of the vein showed no abnormality, but that of the artery was rigid, calcareous, and brittle. A loop of fine catgut was tied with a half knot round the vessels 0.5 cm. beyond the divided ends. The edges of the artery and vein were then sutured together by means of a series of mattress stitches tied over the catgut so as to evert the coats of the vessels and bring the intima of each into apposition. For these mattress sutures the finest round curved needles and the finest silk soaked in sterilized olive oil were used. The clamp on the vein was removed first and the blood flowed past the juncture as far as the clamp on the artery and no oozing occurred from the anastomosis, but when the clamp on the artery was taken off blood escaped from one point; this was completely con-

trolled by a stitch passing through the everted margins of the vessels. The vein was now seen to be distended and pulsating with the artery. At the end of a few minutes, as the wound remained perfectly dry it was stitched up. Healing by first intention without any indication of oozing from the anastomosis.

The anæsthetic used was scopolamine, morphine, atropine, and spinal analgesia with glucose stovaine. When the anastomosis was half completed the patient complained of pain in the wound and ether was then given by the open method. Duration of operation one and one-quarter hours.

The progress of the case after the operation was perfectly straightforward. On the next day the foot was warm and painless and the discolored areas less obvious. There was no œdema. Doubtful pulsation was felt over the posterior tibial vessels at the level of the internal malleolus. No distention or pulsation of the superficial veins. On August 18 there was pulsation over the popliteal vessels and over both anterior and posterior tibials. After this date, however, pulsation was never again felt below the femoral artery in Scarpa's triangle.

On August 29 general massage of the leg was started. The gangrenous patches on the toes had separated and the original amputation wound was almost healed. The areas of discoloration on the foot and toes had practically disappeared.

The patient started walking four weeks after the operation; neither pain nor œdema was produced by this exercise. He was discharged on October 16.

The patient was readmitted to the hospital under Sir John Rose Bradford on October 21 suffering from aphasia and right-sided hemiplegia of gradual onset. It was thought that the condition was due to a cerebral thrombosis and had no connection whatever with the arteriovenous anastomosis. The patient made a rapid recovery and was discharged on November 25. The circulation in the left foot at that time was perfectly satisfactory and except for the absence of the middle toe the foot had all the appearances of a normal one.

Since this paper was sent to press I have again (Feb. 21, 1912, over six months since the operation) seen the patient. Although he has had a chilblain on the left great toe, the whole foot is warm, normal in color, and painless, and the patient can walk with comfort.

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- ³³ Glasstein: Terapevitcheshoie Obozrénie, 1911, p. 365 (reviewed in Journ. de Chir., 1911, p. 275).
- ³⁴ Wieting: Deut. med. Woch., 1908, S. 1217.

FRACTURE OF THE RADIUS ABOVE THE ATTACHMENT OF THE PRONATOR QUADRATUS MUSCLE.*

BY EMORY G. ALEXANDER, M.D.,

OF PHILADELPHIA

Demonstrator of Fracture Dressings, Jefferson Medical College and Woman's Medical College; Assistant Surgeon, Kensington Hospital for Women; Surgeon to Out-Patient Department, Episcopal Hospital, and Children's Hospital, Mary J. Drexel Home.

IN reviewing the writings of the old surgeons, one is filled with admiration for their great work in the treatment of fractures. Their knowledge of the causes, deformities, action of muscles, manner of reduction and keeping reduced was truly remarkable. If these men could have had that valuable aid, the X-ray, in studying and treating their fractures, I am sure they would have handed down to the surgeons of to-day methods far in advance of those now in vogue.

In presenting this paper with accompanying X-ray plates, I hope to show that good approximation can often be obtained, if one will but persist and not be too hasty to resort to operative measures.

The following case is a fairly typical one of a fracture in this region. The patient was admitted to the Episcopal Hospital, to the service of Dr. H. C. Deaver, to whom I am indebted for the privilege of treating and reporting the case.

CASE I.—W. D., male, aged forty-one years. Ten days before admission, while at work, patient fell eight feet and as the result of direct force sustained a comminuted fracture of the radius above the attachment of the pronator quadratus muscle.

The attending physician, failing to get good approximation of the fragments, referred the case to the Episcopal Hospital for an operation.

The first X-ray showed the upper fragment abducted and

* Read before the Philadelphia Academy of Surgery, February 5, 1912.

rotated outward and the lower fragment strongly pulled over toward the ulna.

The patient had been under the care of a very skilful physician, who had first treated the fracture in the usual semipronated position, with long palmar and short dorsal splints, and later on a Bond splint, without gaining a good approximation of the fragments.

We had made an internal angular splint (Fig. 1), somewhat pistol shaped at the wrist, so as to strongly adduct the hand, hoping through the action of the external lateral ligament, and possibly the cartilage and the carpal bones, to pull or force the lower fragment in position.

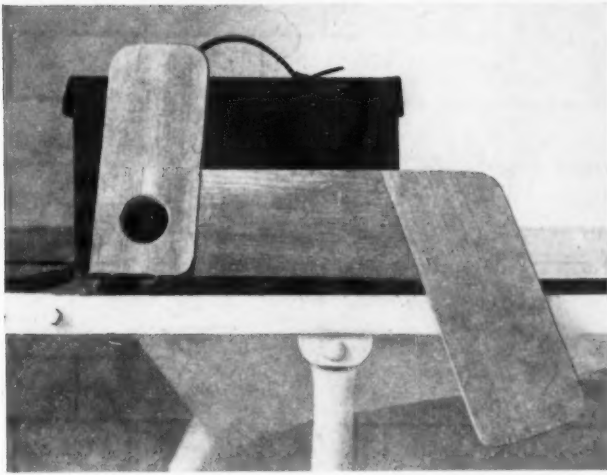
The X-ray of the bones in this position showed that our efforts had not been entirely successful (Fig. 2). The failure seemed to be due to the upper fragment, as this was not affected by the position or adduction of the hand. As the lower fragment seemed to occupy almost a normal position, our efforts at reduction were next directed to the upper fragment.

To overcome its deformity, the arm was placed on an anterior angular splint, likewise pistol shaped at the wrist (Fig. 3), and as in the previous dressing a short straight splint was applied posteriorly from the elbow to the wrist (Fig. 4). This changed the arm from a semipronated to a supinated position and relaxed the flexors of the forearm, thus producing one of the fundamental principles in the treatment of any fracture, muscular relaxation. It also supinated the lower fragment of the radius, bringing it in apposition to the upper fragment. The X-ray of the fracture in this position showed the bones to be in perfect alignment (Fig. 5). Fig. 6 shows end result.

As some difficulty had been encountered in gaining this approximation, and as the fracture had been frequently disturbed during the ten days prior to admission to the hospital, and as there was no attempt at union, the splints were left on for twelve days. During these twelve days the bandages were frequently removed, without disturbing the splints, which were held in place by adhesive plaster, the soft parts inspected and bathed with alcohol, and gentle passive motion given the fingers.

I believe this was unnecessarily long to keep the hand adducted, as a few days in this position would have been sufficient. At the expiration of the twelve days a short straight posterior

FIG. 1.



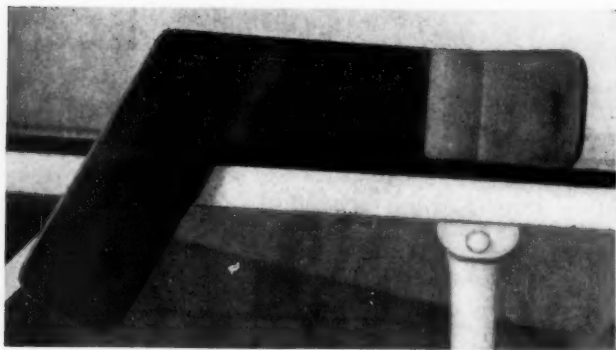
Internal angular splint to secure adduction of hand.

FIG. 2.



Arm on internal angular splint, pistol shaped at wrist; hand strongly adducted; deformity much improved.

FIG. 3.



Anterior angular splint to procure adduction of hand.

FIG. 4.



Position of arm as shown in X-ray plate (Fig. 5).

FIG. 5.



Arm on anterior angular splint, pistol shaped at wrist; hand adducted; perfect alignment.

FIG. 6.



End result of Fig. 2.



FIG. 7.

Fracture of radius with typical deformity.

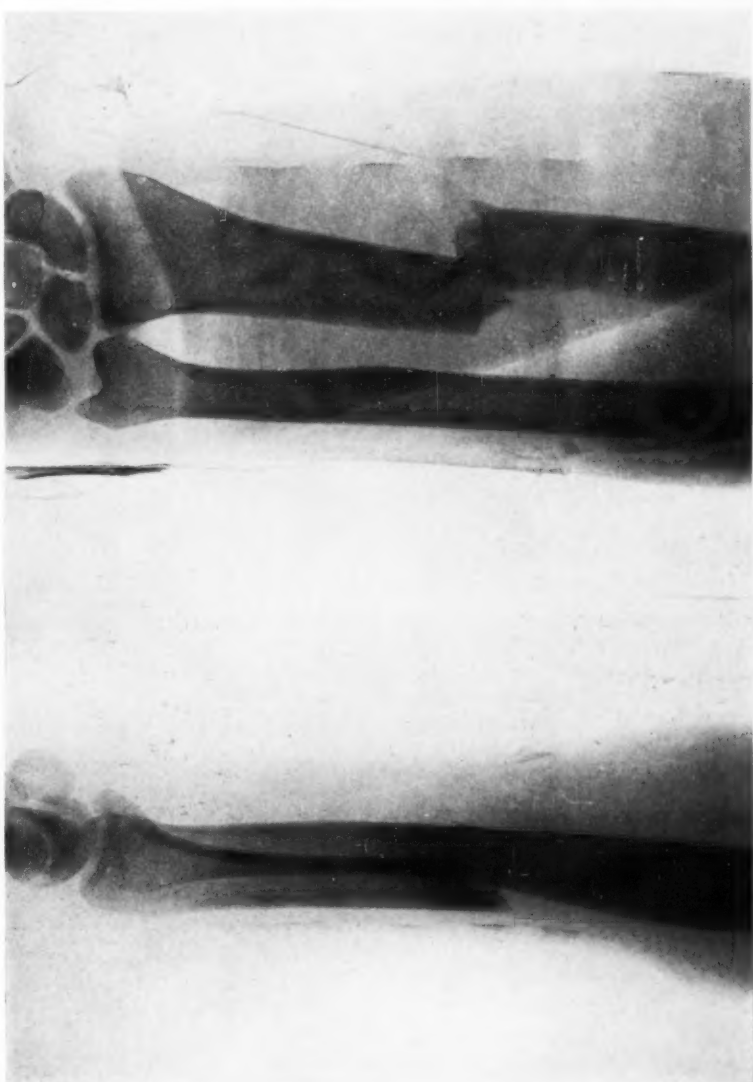


FIG. 8.

Deformity slightly corrected by interosseous padded splint; intolerable to patient; produced pressure ulceration.

FIG. 9.



Arm semipronated; hand adducted; upper fragment tilted forward by action of biceps.

splint, combined with an anterior angular splint, straight at the wrist, was applied. This latter splint should be substituted as soon as possible, as it places the hand in a more comfortable position and minimizes the chances of a stiff wrist.

The method sometimes used of treating fractures of the forearm in a semi-pronated position with a small interosseous padded splint to force the fragments apart is a dangerous one, as so much force is required that pressure ulceration is apt to occur.

Caswell, in referring to this manner of treatment, says: "If useful, intolerable; if tolerable, useless."¹

In a previous case (Fig. 7) of fracture of the radius above the pronator quadratus, an interosseous padded splint was used, correcting to a slight degree the deformity (Fig. 8). This treatment was discontinued, as the interosseous splint produced superficial ulceration. Later the arm was placed on an internal angular splint, pistol shaped at the wrist, to strongly adduct the hand (Fig. 9). This position produced almost a perfect approximation, except for the upper fragment, which was tilted forward by the action of the biceps.

In treating this fracture, not only should one try to get perfect alignment, but also, as Lansdale urged, "keep the fragments in their normal position as to their axis."²

Nélaton, in speaking of fractures of the lower end of the radius, says that Dupuytren laid great stress on the importance of overcoming radial displacement of the lower fragment. He used palmar and dorsal splints, as for fracture of both bones, and after they were applied added along the ulnar border of the forearm and hand an iron band, bent on the flat at the wrist, so as to draw the hand strongly to the ulnar side by means of tension on the external lateral ligament of the wrist.³

Amesbury, in speaking of fractures of the base of the radius, says not to allow the splint along the ulnar border to extend lower than the wrist. He says: "The hand should be suffered to drop as low as possible before it is confined to the

flat part of the back of the splint." "If the hand be confined down in this way it will act as a lever upon the carpal portion of the radius and tend to raise it."⁴

Lansdale, after describing Dupuytren's splint to secure adduction of the hand in fractures of the lower part of the shaft of the radius, says: "When the position of extreme supination is employed, neither the radial nor the ulnar splint is necessary, for then the portions of bone have not the same disposition to fall toward the ulna."⁵

According to Packard, Nélaton's dorsal splint for securing adduction of the hand was originally described by Goyrand in 1836.⁶

I wish to thank the radiographers of the Episcopal Hospital, Dr. T. S. Stewart and his assistant, Dr. A. R. Wilkinson, for the many excellent X-rays of these fractures.

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- ³ Nélaton: Pathologie Chirurgicale, Paris, 1844, vol. i, page 745.
- ⁴ Amesbury: Practical Remarks on the Nature and Treatment of Fractures, London, 1831, vol. ii, page 604.
- ⁵ Lansdale: Practical Treatise on Fractures, London, 1838, page 148.
- ⁶ Packard: Ashhurst's International Encyclopædia of Surgery, vol. iv, 1884.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, held at Bellevue Hospital, February 28, 1912.

The President, DR. CHARLES L. GIBSON, in the Chair.

FRACTURE OF THE SURGICAL NECK OF THE HUMERUS TREATED WITH LANE'S PLATES.

DR. JOHN B. WALKER presented a boy, aged 16 years, who sustained a fracture of the surgical neck of the humerus for which, immediately after the accident, a Velpeau and modified Sayre bandage with an axillary pad was applied. A radiograph showed the head rotated outward and upward, with marked inward displacement of the upper end of the lower fragment. Reduction was impossible; 14 days after the accident the fracture was exposed by incision; the fragments were brought into perfect position, and retained by a three-hole Lane plate. A plaster bandage was applied, which included the shoulder and elbow. On the fourth day the patient was out of bed. On the fourteenth day the bandages were removed, and primary union was found present. Massage and active movements were begun. Six weeks after the operation, he was able to work. Eight weeks after the operation he could abduct the arm to normal position, and there was only a slight limitation to external rotation.

OPERATIVE TREATMENT OF FRACTURE OF THE FEMUR.

DR. WALKER also presented four cases of fracture of the femur in which the result of ordinary methods of treatment not having been satisfactory, he had exposed in each the fracture by incision, had overcome the shortening, brought the fragments into perfect alignment, and applied a Lane plate to maintain the position. A most satisfactory result had followed in each case.

DR. JOHN A. HARTWELL said the subject of plating fractures as universally as it was being done, not only in New York but

throughout the country, was well worthy of discussion. The impression seemed to have gotten abroad that plating fractures of the femur was a safe and simple procedure. Personally, he had had one experience with the operation which proved that it was a very serious one. The case was that of a man with a recent fracture of the lower third of the femur with an inch and a half or two inches of shortening; all efforts to reduce it failed, and on the sixth day an open operation with plating was done under every possible precaution, but in spite of this infection occurred, and the man was confined to the hospital with suppuration and necrosis of the femur for ten months, and when he finally left there was still an inch and a half shortening. Such an experience, of course, was exceptional, but Dr. Hartwell said he knew of other cases where the results were almost as bad. He had also seen cases where a slight degree of infection had followed the open operation, requiring the removal of the plates, and he expressed the view that where one was dealing with so serious a possibility as an infection of the femur, one should think twice before subjecting a patient to such an operation. In the abdominal cavity, the peritoneum could take care of a certain amount of infection, but infections about the femur were very serious—more so than in many other regions of the body.

While the literature on this subject abounded with innumerable cases of the splendid results following the insertion of the Lane plates and other open methods, the reports to the contrary were very scarce. Personally, Dr. Hartwell said, he knew of four cases where an amputation became necessary after the open treatment of fractures.

DR. WILLIAM A. DOWNES said he had seen one case of amputation and death following the treatment of a fracture of the femur in the upper third by Lane's plates, in a fat man of 62. In that case the fracture was first treated several weeks by the usual extension methods, then a plaster case was applied, and finally, in a last effort to maintain reduction, the fragments were plated. In about three weeks the wound began to show evidences of infection and the plates were removed. Amputation became imperative, and death finally occurred.

DR. WOOLSEY said he does not resort to the use of the Lane plates unless other means of treatment have failed. The speaker said he had seen a number of cases where a mild grade of infection followed the use of the plates, but he had never had

an infection severe enough to cause necrosis of the bone or to interfere with union.

DR. WILLIAM DARRACH said he agreed with Dr. Woolsey, that the plates should not be used unless other methods had failed and it became absolutely imperative. In the treatment of any form of fracture, the simpler the method of treatment employed, the better, and any case where satisfactory reduction could be obtained should be treated by the closed method. Where satisfactory reduction was impossible, the fragments should be exposed, but as little foreign material used in the wound as possible.

Thus far, Dr. Darrach said, he had treated 99 cases of fracture by the open method, and in 16 of these he had used the plates.

DR. CHARLES L. GIBSON said he was glad to hear the remarks of Dr. Hartwell and the other speakers on this subject, and personally he did not believe that the impression should go forth from the New York Surgical Society that the treatment of fractures should preferably be by the open method.

Dr. Gibson said he now had under his observation a man who was treated at Bellevue Hospital within the past 18 months for a fracture through the upper fourth of the femur. The plating operation had been done, and from the nature of the fracture in that case it was apparently justified, but the results, as shown to-day, were very bad—in fact, they could not have been worse without any treatment. In spite of his disability he had been able to get about pretty well, until he recently sustained a fracture of the opposite leg.

DR. WALKER said he had done the open operation in 19 cases of fracture of the femur, and in none of them did any serious results follow. In all of these cases, other methods of reduction had first been tried. (He had been compelled to take out the plates because of infection.) By means of the Lemon fracture-reducing apparatus which he demonstrated, he had been able to secure reduction in cases that were otherwise irreducible. The speaker said he did not limit the use of this apparatus to cases where an open operation was indicated.

GIMLET AND BAR METHOD OF OPEN OPERATION IN FRACTURES.

DR. HOWARD LILIENTHAL presented the following cases to illustrate his method of open operation in fractures:

CASE I.—*Fracture of the femur:* The patient was a laborer,

23 years old, who was admitted to Bellevue Hospital on September 7, 1911, with a fracture of the femur at the junction of the middle and lower thirds. A skiagram showed a transverse fracture of the bone, with spicules projecting upward and downward, and with the lower fragment over-riding the upper by more than an inch.

Operation, September 14, 1911: In order to maintain constant traction on the limb, and if possible overcome the over-riding after the exposure of the fragments, a Buck's extension was applied in the following manner: Instead of using strips of mole-skin plaster, Dr. Lilienthal applied a loop of wet cotton flannel reaching from above the knee down and around the foot and above the knee on the other side; this was firmly held in position with a moistened cotton flannel bandage, and nearly 100 pounds of traction applied.

The fracture was then exposed through an eight-inch antero-external incision, splitting the quadriceps fibres. Upon inspection it was found that the traction had scarcely affected the over-riding, and the lower fragment was displaced outside the upper. After chiselling away the projecting spicules, the two ends of the bone were brought into as perfect alignment as possible, and a single gimlet screwed into the bone near the end of each fragment. Before the gimlet could be used, it was necessary to drill a small hole into the bone, because of its hardness. Into each of these drill-holes made near the ends of the fragments, an ordinary gimlet was inserted and left *in situ*. A small steel bar was then inserted between the gimlet heads, and a plaster bandage carried around the bar and gimlets to secure fixation. The wound was then packed and a dry dressing applied, together with a long external splint reaching to the axilla and a right-angled foot-piece.

A skiagram, taken two days after the operation, showed that the ends of the fragments were in poor alignment, and Dr. Lilienthal decided to make a second attempt to reduce and fix them. Accordingly, on September 19, he removed the packing and withdrew the gimlets. Then, while an assistant made traction and produced the proper motions, he finally succeeded in getting the ends of the bone into apposition. Four gimlets were then inserted, two in each fragment, the steel bars placed between the gimlet-heads, and after fixing these with a plaster-of-Paris bandage, the wound was dressed as before.

On October 5 the wound was inspected, and the gimlets and packings removed. For some days following the operation, the patient had a slight temperature, going up as high as 101° F., when it gradually subsided to normal. A plaster spica was applied. At the present time, the right extremity was one-eighth of an inch shorter than the left and function was excellent, though the muscular adhesions still somewhat limited the motion at the knee.

CASE II.—*Compound fracture of the tibia and fibula:* The patient was an iron worker, 42 years old, who was admitted to Bellevue Hospital on August 3, 1911, after having fallen four feet from a ladder. Examination revealed a fracture of both bones of the left leg about two inches above the ankle, with the lower end of the upper fibular fragment protruding through the skin for an inch and a half. The wound bled freely, and the foot was adducted. An attempt was made to reduce the fragment, and a temporary dressing was applied. A skiagraph showed the reduction to be unsatisfactory, and Dr. Lilienthal decided to operate.

With the patient under ether an attempt at reduction was made, but it was also unsuccessful. A six-inch incision was then made over the lower end of the tibia so as to expose the fracture line. It was found that the lower fragment of the tibia had been displaced to the fibular side of the upper fragment, but by manipulation of the foot and the use of a bone hook he was able to bring it into proper alignment. He then screwed two gimlets into the anterior surface of each tibial fragment, and crossed two short steel rods between their heads, thus fixing the gimlets and, through them, the fragments by means of a plaster bandage passed around the heads of the gimlets and the interplaced rods. The wound was left open and a dry dressing applied, and a posterior and two lateral splints were applied to the leg.

On August 31, 1911, the gimlets were removed, and the packing, which was found clean and fresh, was changed. The patient made an afebrile recovery, and on September 30, when the wound had healed, a plaster case was applied to the leg. He left the hospital on the following day, to return later for the removal of the case. As presented to the Society this patient walked well, but there was still some stiffness at the ankle.

Dr. Lilienthal said the method he had employed in these two cases was a modification of the method first described by Dr.

Leonard Freeman, of Denver, for treatment of fractures of the tibia and afterwards fully reported in the *Transactions of the American Surgical Association*, vol. xxix, by which Dr. Freeman sought to overcome the necessity, in treating fractures by the open operation, of putting in an apparatus which would have to be subsequently removed. His method, essentially, was to insert four drills into the bone, which were left protruding beyond the skin for a considerable distance, and which were held in place by two steel bars of suitable shape and kept parallel by means of clamps. After the lapse of a certain period of time, the bar was taken off and the drills removed. Dr. Taylor, of Port Arthur, had modified this method by substituting plaster-of-Paris fixation for the clamp, and Dr. Lilienthal said he had further modified it by substituting ordinary gimlets for the drills and by applying the method to other bones than the tibia. In inserting these gimlets into the bone, no attention was paid to the alignment of the fragments. After their insertion, however, an effort should be made to get the fragments into perfect apposition and then keep them so by inserting a steel bar between the gimlet-heads and making the fixation permanent by imbedding the bars and gimlet-heads in a plaster-of-Paris bandage. The wound was then treated as an open fracture, or it could be closed by strips of adhesive plaster, and in the course of two or three weeks the gimlets were usually sufficiently loosened to be taken out without pain to the patient or danger of recurring deformity.

Dr. Lilienthal said that while he would not give preference to this method over the use of the Lane plates in cases of simple fracture, he was strongly in favor of it in dealing with open or infected fractures. By this method, there was less danger of the occurrence of a diffuse osteomyelitis or suppuration in the deeper tissues. There was free drainage, and if an osteomyelitis or suppuration did occur, it would take care of itself. He believed that the method possessed enormous advantages over the use of the Lane plates or wire in cases where there was an open fracture or where infection was present.

CHRONIC ULCER, WITH CARCINOMA OF THE STOMACH:
GASTRECTOMY.

DR. GEORGE WOOLSEY presented a woman, 32 years old, who was admitted to Bellevue Hospital on December 22, 1911. She gave a positive venereal history. She had a miscarriage 14 years

ago, and about the same time she had an oöphorectomy done; since then her menstruation had been irregular, coming on at intervals of from two to four months. A year ago she was operated on at the Post-Graduate Hospital for exophthalmic goitre. There had been considerable loss of weight during the past three months.

The patient's present illness began about a year ago, when she had a slight attack of indigestion. During the past three months she had vomited from time to time, and two weeks ago she had a severe attack of vomiting, with some epigastric pain, which kept her in bed for two days. The vomitus was usually light brown in color, but contained no blood. On December 22, 1911, after she had eaten practically nothing, she became dizzy and lost consciousness, and after recovering from this she vomited a large quantity of bright blood and numerous large clots. There had been no pain before this attack, only anorexia. There had always been more or less tenderness over the epigastrium, especially in the last two weeks. On December 30 the patient was put on a Lenhartz diet, but she frequently vomited and felt distended, and on two occasions she had a definite hæmatemesis, with coffee-ground vomitus and clots. The stools were dark. The urine contained a trace of albumin and a few leucocytes and pus-cells. The Wassermann was weakly positive. A blood count, made on December 28, showed 11,400 leucocytes, with 3,760,000 red cells and 35 per cent. of hæmoglobin. A week later there were 15,000 leucocytes, with 3,550,000 red cells and 38 per cent. of hæmoglobin.

Operation, January 7, 1912: Upon exposing the stomach, a large indurated mass was found upon the antero-inferior aspect of the pyloric portion of the stomach. No enlarged glands could be made out. A partial gastrectomy was done, together with a posterior gastrojejunostomy. The post-operative course was practically uneventful, and when the patient was discharged, on February 3, 1912, she was able to eat almost any kind of plain food, and had no symptoms referable to the stomach.

The pathologist reported that the specimen showed a colloid carcinoma implanted upon a gastric ulcer. The extreme vascular changes and the presence of what seemed to be small gummata suggested a luetic process.

The points of interest in the case were (1) the absence of the typical hunger pains, relieved by eating, vomiting, etc., in fact of almost any pain; (2) the commencing carcinoma on the base

of an old ulcer. This is the second case among the last three calloused ulcers removed by pylorotomy that has showed commencing carcinoma.

The Lenhartz diet was not well borne, either before or after operation. During the latter period it was found that if the eggs were omitted the milk and cream were well taken.

CARCINOMA OF THE STOMACH: PARTIAL GASTRECTOMY WITH POSTERIOR GASTROJEJUNOSTOMY.

DR. WOOLSEY presented a man, 41 years old, who was admitted to Bellevue Hospital on January 25, 1912. He had typhoid fever about 20 years ago. Denied lues. He had been constipated during the past year. Nine months ago he first began to experience pain in the epigastric region, coming on about half an hour after taking food. He would then vomit and feel relieved, the vomitus always being very sour. No blood had been noticed in the vomitus or stools. There was no history of vomiting for about six weeks prior to his admission. During his illness he had lost 50 pounds in weight and felt very weak.

Examination revealed tenderness in the epigastrium, and on deep inspiration a hard, indistinct mass could be felt high up in that region. The liver edge could be felt, but the spleen was not palpable. The urine showed nothing abnormal. A blood count gave 7700 white blood-cells, with 76 per cent. of polymorphonuclears and 37 per cent. of hæmoglobin. The red cells numbered 3,360,000.

Operation, February 2, 1912: Upon exposing the stomach, a mass was found at the pyloric end, about six inches long and two inches in diameter. No enlarged glands were found. A partial gastrectomy was done, with a posterior no-loop gastrojejunostomy. The patient made an uneventful recovery from the operation, and at the present time was eating and feeling well. The pathological diagnosis was colloid adenocarcinoma, with marked adenohyperplasia of the normal wall of the stomach.

FORWARD DISLOCATION OF THE ELBOW, WITH FRACTURE: BONE PLATING.

DR. WOOLSEY presented a man, 42 years old, who was admitted to Bellevue Hospital on January 8, 1912. On that day he had received a blow over the left, flexed elbow, after which he was

unable to move the left arm on account of the pain. An examination showed a contused wound over the base of the left olecranon and extending to the bone. There was a fulness over the lower end of the joint, which was flexed and could not be fully extended. The X-ray showed a fracture through the olecranon, extending from in front backward and downward. The radius and the lower fragment of the ulna were dislocated forward.

On January 12, Dr. Woolsey made a longitudinal incision, two inches long, over the posterior surface of the upper end of the ulna; there was some difficulty in reducing the lower fragment, but this was finally accomplished with the aid of a bone-hook, but when the instrument was removed, the deformity was immediately reproduced, owing to the obliquity of the fracture. Lane plates were thereupon introduced to keep the fragments in apposition.

About a week after the operation the incision broke down and granulated, and an infection of a mild grade occurred. The X-ray at this time showed that the dislocation was reduced, with the fragments in very good position. The patient left the hospital with a small granulating area, but was readmitted on February 12 with a sinus leading down to the plate. Four days later Dr. Woolsey reopened the incision and removed the plates. The wound was resutured, and healed by granulation.

At the present time the patient had fairly good motion, with almost complete extension and flexion to less than a right angle. As yet no massage nor passive motion had been employed. The patient left the hospital on March 7, 1912.

In connection with this case, Dr. Woolsey exhibited the X-ray plates taken before and after operation, the latter showing complete reduction. He called attention to the fact that Stimson, in the Sixth Edition of his book on "Fractures and Dislocations," published in 1910, stated that up to that time the total number of reported cases of this form of injury was less than 25, including seven cases like the present one, where there was a fracture through the upper end of the ulna, the olecranon remaining in position. Most cases were due to a fall on the flexed elbow.

CASES ILLUSTRATING STOMACH AND GALL-BLADDER CONDITIONS.

DR. JOHN A. HARTWELL presented five cases illustrating various phases of the surgery of the stomach and gall-bladder. These cases were grouped together because of the confusion and diffi-

culty in making an accurate diagnosis in this class of lesions, and were selected as examples very commonly met with. Three of the cases were diagnosed as gastric ulcer prior to operation, and in only one of these was an ulcer found, one being a dilated stomach due to gastropptosis and the other being a cholelithiasis. One was diagnosed as cholelithiasis and no lesion was found, unless a kink in the appendix could be so called. The fifth was correctly diagnosed as gastropptosis, but many of the clinical findings here also suggested the possibility of a gastric ulcer. A study of the case histories explained the reasons for the errors in diagnosis, and might be of value in aiding toward their avoidance in the future.

In reporting the two cases of gastropptosis, Dr. Hartwell emphasized the satisfactory results obtained by the "hammock" operation, together with the ease of its performance and the sound surgical principle upon which it rested. He deprecated combining it with gastro-enterostomy unless an actual mechanical obstruction of the pylorus existed which would not be relieved by the correction of the malposition, or unless an actual ulcer could be demonstrated in the pyloric half of the stomach or in the duodenum.

He further said that in some of these cases where this "hammock" operation was done, there had been no recurrence of the condition after two years. Where the whole length of the transverse colon was used, it gave the stomach a pretty strong, wide support; furthermore, with the patient in the upright position it threw the weight of the stomach backward against the spinal column. As further evidence that there was no elongation of this support in the course of time, Dr. Coffey had taken X-ray pictures of the colon after the introduction of bismuth, and these showed the colon in normal position as long as two years after the operation.

THORACIC ANEURISM TREATED WITH GOLD WIRE AND GALVANISM.

DR. WILLIAM C. LUSK read a paper with the above title, for which see page 789.

In connection with this paper Dr. Lusk showed a specimen of an innominate aneurism which had increased in size until it reached to beneath the patient's chin. Dr. Lusk had wired this aneurism four times, and he demonstrated a comparatively limited area of laminated fibrin deposit on the sac-wall, in which

lay embedded an aggregation of loops of wire, and also projecting centrally into the aneurismal cavity from the peripheral mass a further deposit of laminated fibrin supported in the meshes of a snarl of wire. Many centrally located loops of wire presented themselves free from fibrin and untarnished.

A NEW DRESSING FOR SKIN-GRAFTING.

DR. ARTHUR S. VOSBURGH presented a man upon whom skin-grafting was done following the excision of a carbuncle on the back of the neck. The method employed was as follows: The grafts were covered with zinc oxide adhesive plaster which was first sterilized in formalin vapor. These strips of plaster were placed close together, leaving a very small interval between them to allow for the escape of secretion. They were left *in situ* for a period of from six to eight days, the superficial dressings being changed as required.

In commenting upon this method, Dr. Vosburgh said he would not take that time to enter upon a consideration of the phenomenon of cytolysis, which by its presence or absence made for failure or success in all transplanting operations. Certain mechanical principles were important, however, whether one employed the Reverdin, the Thiersch, the Wolfe, or the Krause method. The success of the operation depended primarily on the maintenance of cellular vitality; the grafts must quickly establish nutritional relations with the area covered, and it was obvious that once placed in position, the transplanted skin or epidermis should not be moved. Formerly, the grafts were covered with rubber tissue, silver or gold foil, or wide-meshed tulle rendered non-absorbent with sterile paraffin, and a dry or moist sterile gauze, held in place by bandages, completed the dressing. Later operators found that leaving the grafts exposed to the air gave much better results, and this would be the ideal method were it not for the danger of the grafts becoming dislodged through some movement of the patient, intentional or otherwise. Attempts had been made to protect the grafts with a wire cage or some similar device, but the range of usefulness of this method was limited.

Dr. Vosburgh said that having observed the behavior of epithelium in chronic ulcers that were covered by zinc oxide adhesive plaster, he was led to apply this dressing directly over skin grafts. He had employed the method in a number of cases

during the past year where it seemed impossible or at least improbable that any other form of dressing could be maintained in position, and it had proven successful on the back, the nates, and in regions about joints. The speaker said all observers agreed that the superficial layers of skin grafts were exfoliated, and this often led the uninitiated to fear that the graft had failed. It was the separation of the graft into layers that rendered the success of this method possible.

DR. FRANK S. MATHEWS said he first learned of this method of skin-grafting from Dr. Vosburgh about a year ago, and since that time he had used it successfully in a number of instances. In every case the grafts had taken. In a case in which he used this method 3 weeks ago there were very extensive burns of the face, with complete ectropion of the lower lid. Skin grafts were applied by the method Dr. Vosburgh had described. The grafts took completely on an area where by other methods there would be much likelihood of their slipping. The adhesive kept the grafts flat and in addition splinted the eyelids and corner of the mouth. The adhesive strips were removed only when they loosened themselves, *i.e.*, in six to eight days, at which time the grafts had taken. No further dressing was applied other than covering the exposed area with ointment.

DR. COLLINS said he had used the Beck's paste several times for the purpose of covering skin grafts, but he was not yet prepared to express his opinion regarding its value. He had noted that the application of Beck's paste to the area from which the grafts had been taken resulted in a very rapid repair of the denuded area.

COLLAPSE OF A TRANSFUSION DONOR.

DR. BURTON J. LEE presented a man, 26 years old, who acted as the donor in a case of marked secondary anæmia from gastric hemorrhages in a man of 55. Prior to the operation the donor had a normal blood picture. The recipient had 20 per cent. of hæmoglobin, with some normoblasts and megoblasts present, together with slight distortion of the red cells. The hæmolytic test was satisfactory, and the donor gave a negative Wassermann.

The blood was allowed to run for 50 minutes after the connection had been made by means of an Elsberg cannula. At the beginning, the donor's blood-pressure was 160; during the first 40 minutes it fell to 140, and he looked a trifle pale, but insisted that

he felt all right. During the last ten minutes of the transfusion his blood-pressure fell to below 100, and he went into collapse, with dilated pupils, cold perspiration, and relaxed sphincter urinæ; his extremities were cold, with an almost imperceptible pulse. He was inverted and freely stimulated, and his condition soon improved. He was then put to bed, with the foot of the bed elevated.

Four days after the operation he felt well enough to go to a dance, and said he never felt better in his life. His color was good. A week after the operation, his hæmoglobin was about 90 per cent., and at the final examination, made recently, it was between 80 and 85 per cent. The transfusion was done under cocaine anæsthesia.

Dr. Lee said the points of interest brought up by this case were: (1) How long might a transfusion be continued, and what was a fair index of safety? (2) What was the legal responsibility of the surgeon in such a case, and what steps should be taken to protect oneself? (3) The quite marked improvement of the recipient to date, seven and a half weeks after the operation, his hæmoglobin now ranging between 70 and 80 per cent. The diagnosis of the gastric condition was still in doubt, and an exploratory operation had been advised. The transfusion was done not only with a view to temporarily helping the recipient, but also to place him in such physical condition that an exploratory operation might be safely performed.

DR. LILIENTHAL said the collapse of the donor in the case shown by Dr. Lee might possibly have been due to the effects of the cocaine. As for relieving oneself from legal responsibility in case of a fatality or accident, Dr. Lilienthal said that at the Mt. Sinai Hospital they had a printed release which the patient was requested to sign before operation. While such a release probably had no legal value, patients who signed it were not so apt to sue as might otherwise be the case.

DR. HARTWELL said he thought the collapse of the donor in the case of transfusion reported by Dr. Lee was rather late to be attributed to the effects of the cocaine. Possibly it was due to the long duration of the transfusion. In his own cases, the speaker said, he preferred novocaine to cocaine, and he thought it wise to suspend the transfusion when the blood-pressure dropped, say from 160 to 130 mm. A sudden decided drop in

the blood-pressure should serve as a warning, and in case of collapse the donor should be placed with head low, and given whiskey and coffee per rectum.

SUBPHRENIC ABSCESS.

DR. VOSBURGH presented a woman, 38 years old, who was admitted to Bellevue Hospital on September 28, 1911, with the history that a month prior to her admission she began to suffer from a dull, aching pain in the right side, with chilly sensations, fever, and loss of appetite. The pain was aggravated by any movement involving the muscles of the back or flanks, and it sometimes radiated to the iliac regions. She felt most comfortable when lying on the left side, and complained of soreness to the touch over the right lumbar region. There were no symptoms referable to the stomach, liver, or bladder. The patient was becoming progressively worse.

Upon examination of the abdomen, there was rigidity and tenderness over the right flank, as far forward as the anterior axillary line. Over this region, an indefinite, non-movable mass could be made out. It seemed soft and was not definitely defined, extending from under the costal border down near the crest of the ilium. The liver and spleen could not be felt; the appendicular region seemed normal. The patient had a septic temperature, at times going as high as 104° F.

Operation, October 3, 1911: Through an exploratory incision above the crest of the right ilium a mass could be felt extending from the right kidney upward and behind the liver. A second oblique incision was then made in the right lumbar region, and upon incising the fatty capsule of the right kidney, four ounces of thick pus escaped. From this abscess, a narrow, fistulous tract extended upward behind the liver and under the diaphragm. Free drainage was established, and following this the patient's temperature dropped to 99.5° , and remained so until October 22, when she had a chill, and a temperature elevation to 103° . The wound was thereupon explored, but no pockets of pus were discovered. The patient continued to have a daily range of temperature from 99° to 100° until November 23, when it had practically fallen to normal. She left the hospital on December 2, 1911, with a small discharging sinus.

Stated Meeting, held March 13, 1912.

The President, DR. CHARLES L. GIBSON, in the Chair.

DISAPPEARANCE OF RECURRENT CARCINOMA AFTER
INJECTION OF COLEY'S MIXED TOXINS.

DR. WILLIAM B. COLEY presented an unmarried woman, 39 years old, whose paternal aunt had died of cancer of the breast. The patient had suffered from marked curvature of the spine since early childhood, necessitating the wearing of an aluminum corset which produced constant irritation of the breast. A very small, movable tumor appeared in the left breast, which was removed in the spring of 1905. The clinical diagnosis of fibroadenoma was confirmed by Dr. W. C. Clark, Pathologist of the General Memorial Hospital. There was no evidence of malignancy at that time. Two years later another small nodule appeared in the region of the first, and microscopically this proved to be carcinoma. The entire breast was thereupon removed, but on account of the poor general condition of the patient and the very small size of the tumor, the axilla was not opened and the pectoral muscles were not removed. One year later a similar nodule appeared in the outer portion of the right breast; this was very small when discovered, but harder than the one on the other side. In view of the patient's previous history, the entire breast was removed in February, 1908. A microscopical examination was made by Dr. James Ewing, Professor of Pathology of the Cornell University Medical School, who pronounced the disease to be typical carcinoma.

In December, 1908, the patient again consulted Dr. Coley, and he found a well-marked recurrence in the left pectoral and cervical regions. The case was clearly inoperable. For a few weeks he tried the thyroid preparation of Prof. S. P. Beebe, of the Cornell University Medical School, but as the tumors rapidly increased in size in spite of the treatment, it was discontinued. In February, 1909, there was a hard, carcinomatous mass occupying the entire left pectoral region, with typical carcinomatous involvement of the supraclavicular and cervical glands reaching nearly to the mastoid. He regarded the case as absolutely hope-

less, and gave a prognosis of less than six months of life. Being asked by her family if the toxins offered any hope in such a case, he replied that while they might possibly cause some slight retardation of the growth of the disease, there was no hope of a cure, and he advised against the treatment. In spite of this, her sister was anxious that the treatment should be tried, as she wanted to feel that something was being done.

In order to lessen the discomfort associated with the treatment, due to the local irritation of the injections, Dr. Coley directed her family physician, Dr. W. J. Bott, of Palmyra, N. Y., to use only the filtered toxins, which were about half the strength of the unfiltered and very much less irritating. The patient proved exceedingly susceptible to the toxins, very small doses being sufficient to produce moderately severe reactions. The initial dose was half a minim; this was gradually increased to three minims. Within a few weeks her physician wrote that very marked improvement had occurred, and that the tumors were gradually decreasing in size; the improvement steadily continued, and in August, 1909, Dr. Bott wrote that both the pectoral and cervical tumors had practically disappeared entirely. When Dr. Coley examined the patient on February 24, 1910, he could find no trace of a tumor in either the pectoral or cervical region. The patient had regained her normal health and never felt better. There were no glands in the axillæ and no swelling of the arm. Up to this time she had received 104 injections, the dosage ranging between one-half and three minims, and although she strongly objected to a continuation of the treatment, she was persuaded to go on with it and it was continued, with occasional intervals of rest, up to February, 1911. Her acute susceptibility to the toxins not only persisted but became increased, so that toward the end she was scarcely able to tolerate more than a minim and a half.

Dr. Coley said he had made a preliminary report of this case before the meeting of the American Cancer Research Society last April, but that he had hesitated to present her before the Surgical Society until a period of at least three years had elapsed. She had received 160 injections altogether within a period of two years. Her weight, which had fallen to 80 pounds, was now 100 pounds, as much as she ever weighed in her life. The cachexia which she was then beginning to show had entirely disappeared.

While one could not say, even after the lapse of this period, that the patient was cured, yet Dr. Coley thought the fact that an inoperable, recurrent carcinoma, in which the diagnosis was established beyond any doubt, had entirely disappeared under the mixed toxins, was sufficient to justify him in bringing the patient before this Society. It should be further noted that the result in this case was obtained entirely from systemic injections.

In connection with this case, the speaker referred to two cases of carcinoma of the breast reported by Lageux (*Le Bulletin Médical de Quebec*, June, 1909), in which similarly brilliant results were obtained with the toxins, one patient having remained well nearly five years and the other two and three-quarters years.

Dr. Coley said these cases were of particular interest for the reason that, so far as he knew from his own experience and from a very careful review of the literature, they were the only cases in which an inoperable, recurrent carcinoma, with glandular metastases and with the clinical and microscopical diagnosis unquestioned, had ever disappeared under any mode of treatment, and where the patient had remained well for a period of three years.

Dr. Coley said that while during his early experiments with the living streptococcus of erysipelas he had tried the effect of inoculation upon carcinoma as well as sarcoma, after substituting the mixed toxins of erysipelas and *Bacillus prodigiosus* he had practically limited the method to cases of inoperable sarcoma, believing it wise to first establish its value in this class of cases. Among his earlier cases, however, there was one of inoperable carcinoma of the floor of the mouth, involving the lower jaw, where the diagnosis was confirmed by microscopic examination, in which the disease entirely disappeared and the patient was well at the last observation, six years later.

The speaker said he did not report the above cases as offering sufficient justification for adopting the treatment as a routine method in cases of inoperable carcinoma, as he felt that the percentage of cures would probably be very small. He did feel, however, that these cases justified a further and more thorough systematic study of the toxins in inoperable carcinoma, particularly for the reason that his earlier experiments were carried on with a preparation much inferior to the present product. He further believed that, taken together with the two cases reported by Lageux, they furnished sufficient ground for advocating the

routine adoption of a systematic course of treatment with the toxins after all primary operations for carcinoma. This plan had already been adopted by a number of leading surgeons. The treatment could be easily carried out by the family physician, and did not necessitate any interference with the daily occupation or routine of life of the patient.

Dr. Coley said he did not think sufficient recognition had been given to the clinical observations made as to the result of accidental erysipelas in inoperable malignant tumors of all types. A brief reference to these observations still further justified the conclusion which he had offered. In one of his earlier papers, entitled "The Treatment of Malignant Tumors by Repeated Inoculation of the Living Germ of Erysipelas" (*American Jour. of the Med. Sciences*, May, 1893), he reported 38 cases—17 sarcoma, 17 carcinoma, and 4 in which the type of tumor was not stated—in which an attack of erysipelas had occurred, 23 times as an accidental occurrence and 15 times as the result of inoculation. Of the 17 cases of carcinoma, 3 were permanently cured. One, a probable carcinoma, was well five years after the attack of erysipelas. The remaining 13 showed more or less temporary improvement. Of the 17 cases of sarcoma, 7 were well from one to seven years afterwards; the remaining 10 cases nearly all showed improvement, some disappearing entirely but later recurring. In the *American Jour. of the Med. Sciences*, March, 1906, he published six additional cases of cancer, five epithelioma and one sarcoma, in which an attack of erysipelas had intervened in the course of the disease.

PARALYSIS AGITANS IN ONE ARM FOLLOWING BREAST AMPUTATION.

DR. N. W. GREEN presented a woman, 56 years old, upon whom he had operated three years ago for a tender, growing lump in the right breast. The breast together with the muscles and axillary contents was removed, the wound healing by primary union. The pathological report on the tumor showed it to be fibro-adenoma.

For 18 months after the operation the patient had good use of her arm; then she noticed a beginning coarse tremor in the right hand, which gradually grew worse until now she had great difficulty in using it. She now had a well-marked paralysis agi-

tans confined to the right arm and hand. On intention, the tremor ceased.

Dr. Green said he had brought this case up for discussion, as he believed the condition was unusual after breast amputation, and because he had doubt as to whether the operation was the cause of it.

Dr. ROBERT T. MORRIS said the paralysis agitans in this case might possibly be due to an irritation of the nerves caused by retraction of the scar tissue, or to some of the remote effects of injury to the nerves following the operation. In some instances he had seen joint adhesions which had to be broken up under a local anæsthetic. A French writer had attributed some of these symptoms to injury of the posterior circumflex nerve, resulting in a synovitis with adhesions in the joint. Dr. Morris said that surgeons, he at least, had overlooked the tendency to formation of joint adhesions after amputation of the breast until recently.

Dr. JOHN ROGERS said it was inconceivable to him that any direct connection could exist between the breast amputation and the paralysis agitans as the result of the cicatrization of the wound about the nerve plexus. Paralysis agitans was supposed to be a neurosis, which meant nothing whatever. No pathological changes had been found in these cases, and the condition was usually aggravated by all kinds of organotherapy, which was quite suggestive. The occurrence of paralysis agitans after operation must therefore be a mere coincidence.

RESECTION OF THE RECTUM WITH RETENTION OF SPHINCTER.

Dr. N. W. GREEN presented a man, 43 years old, who was operated on six months ago for carcinoma of the rectum. Two years ago, when Dr. Green had operated on him for an attack of acute appendicitis, he made a rectal examination, which showed nothing abnormal in that section of the gut.

The history of his present trouble, so far as could be ascertained, dated back about two weeks, when he began to suffer from constipation and a constant desire to stool. On examination, a stricture admitting the tip of the index-finger was found, two and a half inches above the anus. A section of this was removed, and upon microscopic examination proved to be gelatinous carcinoma.

As the patient was a man with considerable adipose tissue, and as his family strongly objected to his having an artificial

anus, it was decided to remove the growth by the coccygeal route. This was accomplished with the assistance of Dr. Walton Martin, by splitting the sphincter posteriorly and carrying the incision well up on the sacrum. The sacrococcygeal articulation was divided and the top of the coccyx turned outward, putting the muscular attachment on the stretch. This made it easier to find the proper planes in the dissection. The gut was then divided above the growth and freed anteriorly, the levator ani was cut, and the rectum together with the growth was turned backward, bringing it out behind the sphincter. The lower portion of the rectum was then cut around, and the growth, with about four and a half inches of the rectum, was removed. The proximal portion of the gut was then drawn down and sutured to the mucous membrane just within the sphincter; this was done under considerable tension. The sphincter was then re-united with suture, and a drain placed behind in the hollow of the sacrum. The patient's convalescence was uninterrupted, and he now had full control of his sphincter.

Dr. Green said his reasons for adopting this route in this case were, (1) the fact that the growth was located low down; (2) that the patient was a man; (3) that he was fat; (4) that it was in accordance with the wishes of his family; and (5) that he believed colloid cancer was more apt to recur locally, and less apt to form metastases.

CARCINOMA OF THE RECTUM: COMBINED ABDOMINAL AND PERINEAL RECTECTOMY.

DR. WALTON MARTIN presented a man, 41 years old, who was admitted to St. Luke's Hospital on December 7, 1911, with a carcinoma of the rectum four inches above the sphincter.

On December 11, 1911, under ether anæsthesia, with the patient in the Trendelenburg position, the abdomen was opened in the median line. The sigmoid colon was clamped at its lower portion, and the gut crushed, tied, and divided with the cautery. The stumps were then invaginated and closed with a purse-string suture, as in appendectomy. The proximal end was brought out through an intermuscular incision on the left side; the distal portion was freed down to the levator ani muscle.

The patient was then placed in the lithotomy posture, and a purse-string suture was passed about the anus. An incision circumscribing the anus and extending over the coccyx in the mid-line was then made in the perineum, the coccyx was resected,

and the rectum and anus were freed from below, the dissection being continued until the entire loosened segment of gut could be removed through the perineal wound. This wound was then closed, with drainage. The patient was then placed in the dorsal position, the levator ani muscles and the peritoneum were sutured, and the abdominal wound closed.

The patient made a slow but satisfactory recovery.

The specimen removed was made up of the rectum and the lowermost portion of the sigmoid, measuring 27 x 7 cm. There was a large hard mass projecting into the lumen of the gut. On section through the tumor, the new growth was found to have infiltrated the fatty tissue about the rectum. One small nodule was found in a mass of fat 10 cm. above the site of the original growth. Microscopically, the mass was shown to be carcinomatous.

Dr. Martin said the case seemed to be of interest on account of the presence of the secondary mass 10 cm. above the main growth, emphasizing the advantage of approaching these tumors through the abdomen from above.

DR. WILLIAM C. LUSK said that Hochenegg, in 1902, had published a tabulation of various operators of cases of carcinoma of the rectum, operated upon by the posterior route, to which he himself in 1908 had added a few other collected cases, making a total of 1244, among which there was freedom from recurrence after three years in 15.6 per cent.

Dr. JOHN A. HARTWELL said he had looked up some 50 cases of carcinoma of the rectum which had been operated on by different surgeons in New York, most of them by the sacral or perineal route, and he had found that only 17 per cent. had remained well for three years, and the recurrences had all taken place at the local site of the operation.

Dr. Hartwell said he could recall at least three recent cases of resection of the rectum, in which, in order to save the sphincter, the bowel had been cut off within less than an inch beyond the limits of the malignant growth. The speaker said he did not favor such a procedure, and he was inclined to agree with Dr. Martin that it was much safer to make the excision very complete and do a left-sided colostomy. Even in cases where an effort was made to save the sphincter, a stricture or incontinence was very apt to result, which was quite as troublesome as the presence of an artificial anus.

Dr. F. KAMMERER said he entirely agreed with Dr. Hartwell.

In his efforts to save the sphincter, he now believed that he had often failed to remove a sufficiently large portion of the bowel. He very rarely did resections of the rectum at present, after which strictures were apt to develop and later on recurrences. The method which he favored was to do a colostomy, and then excise the growth, dropping the closed end of the rectum back into the wound without attempting to bring it down to the anal site. After establishing the inguinal anus, it was comparatively simple to remove the growth by the sacral route, closing the rectum high up, and suturing the opened peritoneum to the stump of the sigmoid. More especially in neglected, far-advanced cases, which one will always meet in hospital practice, this operation was the operation of choice. He could say from his own experience that the mortality, even in desperate cases, was very small.

DR. LUSK said that in suitable cases, where the sphincters were well free from the disease, he would favor resection of the rectum by the combined method rather than amputation. By bringing down the sigmoid flexure for anastomosis with the anal segment and including a good margin of serous surface of the former piece of bowel in each stitch of the suture line, union was made more sure, and the tendency to extensive breaking down of the suture line diminished. A stricture of the bowel need not necessarily follow resection, the conditions favorable for avoiding this sequel being good nutrition of the bowel ends and in even coaptation of the mucous edges. A paralysis of the sphincters would not occur unless the nerves were cut.

DR. ROGERS, replying to Dr. Lusk, said that the nerves supplying the anus lay to the upper side of the levator ani, and if that muscle was detached, paralysis of the sphincter necessarily followed.

DR. LUSK said that the nerve supply of the external sphincter was from the inferior hemorrhoidal and perineal branches of the internal pudic nerves, which branches were all situated below the levator ani muscles. The interior pudic nerves had their origin from the third and fourth sacral roots, and paralysis of the external sphincter had resulted from the cutting of these nerve-roots in high division of the sacrum. The nerve supply of the internal sphincter was from the sympathetic, and could likewise be preserved.

DR. KAMMERER said that when he spoke of a stricture following a resection of the gut, he referred, of course, to a relative

stricture, which caused a certain amount of stagnation and irritation, even if the patient was not conscious of the same. As regards the combined operation in one sitting with the establishing of an inguinal anus and removal of the entire lower segment, he did not believe it had any advantage over the method he practised. If one has decided on a permanent inguinal anus, why not give the patient the benefit of the same some weeks before removal of the rectum? The improvement in the general condition of the patient and more especially the change in size and mobility of the tumor itself are often very striking.

DR. MARTIN, in closing, said there seemed to be some confusion as to what was meant by the "combined operation," and this fact should be considered in connection with the high mortality, to which Dr. Kammerer had referred. The mortality was high in those cases where an attempt was made to unite the two segments of the divided gut. But in the combined operation, in which a permanent inguinal anus was established, and the entire lower segment of gut including the anus was removed, the mortality in Dr. J. A. Blake's series had been strikingly small—18 cases with no deaths.

DR. GREEN, in closing, said the choice of operation in carcinoma of the rectum depended somewhat on the character of the case. In women, for example, it was easier to do the combined operation, while in fat men it presented many difficulties. Personally, he thought that if the combined method was feasible, it was beyond question the proper mode of procedure.

In his own case, Dr. Green said, the carcinoma was of the colloid type, which he believed was more apt to recur at the site of the operation rather than in the form of metastases. If this should be the case a second chance could be offered the patient in the combined operation.

RECKLINGHAUSEN'S DISEASE.

DR. ALEXIS V. MOSCHCOWITZ presented a girl, 14 years old, a native of the United States, of Roumanian descent, who was admitted to the Har Moriah Hospital on May 17, 1911, for the correction of a congenital deformity of the scalp and neck which had become particularly annoying during the past few years. Prior to her admission to the hospital she had been under treatment at various institutions, but at no place was any operative treatment proposed.

Examination showed innumerable pigmented areas, varying

in size from a pin-head to a silver quarter-dollar, distributed over the neck and trunk. Practically the entire right half of the neck was covered by one such pigmented area, studded with numerous nipple-like elevations, of a soft consistency. The entire occiput was involved in a mass of irregular shape about the size of an adult palm. This mass had no distinct pedicle, but it was pendant, and in some respects resembled a cap. It was soft and somewhat cystic, and for the most part painless, excepting just behind the auricle. Within the greater bulk of this mass there could be palpated a number of distinct nodes, of a much firmer consistency than the mass itself, varying in size from a marble to a hen's egg. Upon the periphery of the main growth there were a number of outlying smaller tumors (Figs. 1 and 2).

In connection with this case, Dr. Moschcowitz stated that this patient possessed only a fair degree of intelligence, being about two years behind in her school work. He also called attention to the fact that both sternoclavicular joints were very lax, the left one to such a degree that it could be luxated at will.

Recklinghausen had described a triad of symptoms for the malady known by his name; these were (1) the pigmented areas of the cutis; (2) the nerve tumors; and (3) the retarded intelligence. All three of these were present in this case.

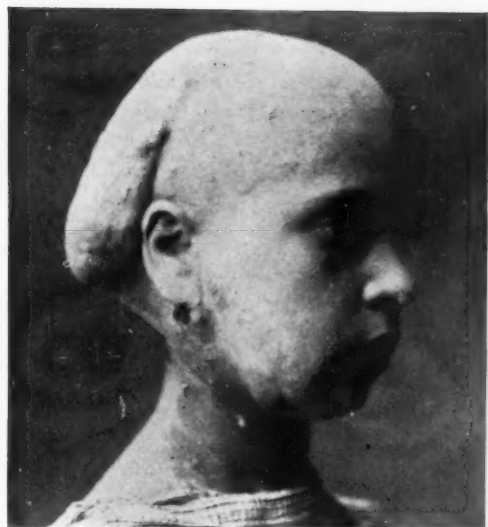
The patient was operated on by Dr. Moschcowitz on May 22, 1911. The operation consisted of an excision of the area chiefly affected, followed by a plastic operation and subsequent suture. Because of tension, the central portion of the wound was left open, the idea being to graft it on a subsequent occasion, but this proved unnecessary, as the entire wound very quickly granulated and became covered with epithelium. The text-books speak of alarming hemorrhages during these operations, but in this case the bleeding was very readily controlled. At a second operation, on February 11, 1912, several neuromata were excised from the neck and submental regions, followed by plastics to improve the cosmetic effect. Further corrective operations were still in view.

Pathological examination revealed the presence of true and false neuromata, with very large, thickened nerve-trunks.

TRIFACIAL NEURALGIA.

DR. MOSCHCOWITZ presented a woman of 54, who for over 20 years had been suffering from trifacial neuralgia, and when he was first asked to see her by her physician, Dr. Wm. Hirsch,

FIG. 1.



Recklinghausen's disease; lateral view.

FIG. 2.



Recklinghausen's disease; posterior view.

11-10-11

she was suffering very intensely from attacks which recurred every three or four minutes.

The woman was admitted to Mt. Sinai Hospital, where Dr. Moschcowitz operated on her on November 11, 1911, under local anæsthesia; the operation consisting of isolating the individual nerves at the point of exit from the foramina, twisting them out according to the Thiersch method, and then tightly plugging each foramen with a silver button, as described by him in the *New York Medical Record*, February 16, 1907.

Dr. Moschcowitz said he was in favor of the Hartley-Krause operation in cases where it was imperatively demanded, but he thought these patients should first have the benefit of a less drastic surgical procedure.

In reply to a question, Dr. Moschcowitz said the operation was done entirely under local anæsthesia. The speaker said he had done this operation about 15 times. In this particular case, the second and third branches of the nerve were resected and twisted out, and the foramina plugged, and in none of his cases had he had occasion to remove the plugs afterward. In one case there had been a recurrence, and a Hartley-Krause operation subsequently became necessary. The object aimed at in this operation was to prevent reunion between the distal and proximal segments of the nerves.

TRIFACIAL NEURALGIA: SECTION OF THE POSTERIOR ROOT OF THE FIFTH NERVE PROXIMAL TO THE GANGLION.

DR. ALFRED S. TAYLOR presented a man, 27 years old, who in the summer of 1902 first experienced pain in the right side of his nose. This lasted for five or six weeks, and recurred in cycles at intervals of several months, gradually becoming more severe. He tried various medicinal and hygienic courses of treatment, and in June, 1910, he had a peripheral operation done on the right infra-orbital nerve at its exit from the foramen. The foramen was not plugged and no relief followed the operation. On the contrary, the attacks of pain became more severe and frequent, and in July, 1911, he had constant spasms of pain, involving chiefly the third branch of the nerve; these attacks would be aggravated by talking or eating, and were so severe that he thought they would drive him insane.

About this time the patient, who came from Texas, was seen by Dr. William A. Downes, who referred him to Dr. Taylor.

Operation, November 11, 1911: Through the Hartley-Krause approach made on the right side, the dura was pushed away from the skull, and the posterior root of the fifth nerve divided proximal to the ganglion. The wound was closed without drainage, and primary union followed, but on the fourteenth day there was a small collection of serum under the anterior edge of the wound. This was aspirated, and following this a small sinus persisted for a few weeks, through which cerebrospinal fluid was discharged. The sinus then closed. The patient had been absolutely free from pain since the operation.

Dr. Taylor said this operation was first suggested by Frazier, of Philadelphia, after rather extensive animal experimentation. Its advantages were that it was comparatively simple, and that there was no interference with the nerve ganglion, which was left to perform its natural functions. After extirpation of this ganglion, interference with the nutrition of the eye on the affected side was exceedingly common; in this case, there had been practically no difficulty with the eye.

DR. OTTO G. T. KILIANI said the case shown by Dr. Taylor was unusual in that the freedom from pain was not accompanied by anæsthesia in the involved areas, because a ganglion operation or resection of the root proximal to the ganglion, in addition to the loss of pain, must produce complete anæsthesia. As to the eye symptoms following this operation, the pupil on the affected side was decidedly dull, although there was apparently no corneal involvement.

Dr. Kiliani said he had seen a number of cases of trifacial neuralgia where there was freedom from pain for over two years after an injection of alcohol, but even a period of over three years did not prove that the case was permanently cured.

DR. ROBERT T. MORRIS said that in connection with this subject of a radical operation for the relief of trifacial neuralgia, he wished to emphasize the importance of first excluding every possible source of peripheral irritation, such as the teeth, eyes, nose, etc. He could recall a number of cases where the patients were subjected to a radical operation without any preceding inquiry into these possible sources of peripheral irritation. He had seen this sin of omission committed by famous neurologists, and he felt convinced that if in every case of trifacial neuralgia these various sources of peripheral irritation were to be sought for and corrected, there would be fewer instances where a radical

operation would be thought necessary. Many neuralgias are precipitated in susceptible individuals by toxic impression from a distant source as well as by peripheral irritations.

DR. TAYLOR, in closing, said there was apparently no anæsthesia in this case; the man was able to feel just as well on one side of the face as the other. There was no possibility of error as to the fact of the division of the nerve in this case, as the ganglion was exposed and manipulated with the forceps, and the various bundles of fibres that made up the root were inspected before the division of the latter. One simply had to take the patient's word for it that he could feel as well on one side of the face as on the other.

PARTIAL GASTRECTOMY FOR PRIMARY LYMPHOSARCOMA.

DR. A. V. MOSCHCOWITZ presented a man of 50, who was admitted to the Mt. Sinai Hospital on June 3, 1911, complaining chiefly of a dull pain in the epigastrium, accompanied by vomiting, and with marked emaciation. On examination, there was found a movable tumor in the epigastric region. Repeated examinations of the gastric contents gave the following average findings, which were very much at variance with the usual results of gastric analyses found in carcinoma of the stomach: total acidity, 60; free hydrochloric acid, 20; lactic acid, absent; no Boas-Oppler bacilli, and a positive reaction for blood. An X-ray examination revealed an indentation of the greater curvature of the stomach, with retarded motility.

Operation, June 22, 1911: A tumor the size of an adult fist was found on the proximal side of the pylorus, involving the stomach wall, which it encircled. A few enlarged glands were found on both the greater and lesser curvatures. The growth was resected, and the operation completed according to the II Billroth method. After closing the proximal end of the stomach, there remained merely a narrow pouch—practically only a tubular prolongation of the œsophagus, into the posterior surface of which the jejunum was implanted.

The pathological examination of the excised tumor and lymphatic glands was made by Dr. F. S. Mandlebaum, and was pronounced a primary lymphosarcoma.

The patient made an excellent convalescence, and left the hospital on the twenty-first day with his wound completely healed. Since then he had regained his normal weight.

Dr. Moschcowitz said that while it was thus far too early to speak of a cure, the result was at least very encouraging, and this fact, together with the comparative rarity of primary lymphosarcoma of the stomach, merited the presentation of the case.

PARTIAL THYROIDECTOMY.

Dr. JOHN ROGERS presented a woman, 24 years old, who had a small thyroid enlargement which had existed about nine years. It had given rise to no symptoms until about four years ago, when she began to complain of weakness, hot flushes, nervousness, and occasional palpitation. These were accompanied by some enlargement of the thyroid, and appeared after she began to work hard as a servant. In April, 1911, she consulted a surgeon, who did a partial thyroidectomy, following which there was no improvement in her symptoms, and since then they had gradually grown more severe. The surgeon now wished to remove half of the remaining lobe of the thyroid.

Dr. Rogers said his object in showing this patient was to illustrate the inadvisability of operating on some of these cases for the relief of symptoms which were supposed to be of thyroid origin. In this case there had been no continuous tachycardia—it occurred only after exertion or excitement. When the patient was quiet the pulse was regularly normal. The blood-pressure had been low, averaging about 90 mm., and the pulse slow.

In such a case, Dr. Rogers said, it has been his experience that no benefit was to be derived from an excision of the thyroid. Her symptoms belonged entirely to the sympathetic nervous system, and the enlargement of the thyroid was simply compensatory, and had to do with the chromaffin secretions. This patient had improved somewhat since the operation under the administration of the adrenal nucleoproteid, $\frac{1}{4}$ gr. every 3 or 4 hours, combined with the thyroid proteids. She represented a group of cases characterized by goitre (without noticeably constant hypo- or hyperthyroidism) and extreme nervous irritability. Under exertion or excitement the goitre generally enlarged from evident congestion, and some hyperthyroidism was then apparent. If the goitre is partially excised there follows either hypothyroidism as in this instance, with its peculiar pallor, dry skin, subnormal temperature, constipation, headache and asthenia and no relief of the nervousness; or the remaining half of the thyroid degenerates and causes a continuous and severe hyperthyroidism instead of the mild alternating hyper- and hypothyroidism. In

these cases the primary disturbance should be regarded as a fatigue of the thyroid which is really secondary to the nervous irritability. The gland seems constantly and unduly called upon to "make good" in some error in nutrition in the nervous or chromaffin system. The thyroid should therefore *not* be ventilated, but it should be rested by section of enough of its nerve and blood supply to stop any of the signs of hyperthyroidism. The hypertrophy is not pathological but compensatory to an increased demand upon the thyroid secretion.

DR. MORRIS said he was very glad that Dr. Rogers had brought up this subject of relative hyperthyroidism. The speaker said he had a patient under his observation at present who was operated on about a year ago for an enlarged thyroid, when the arteries of the gland were tied, without improvement. The patient had been referred to Dr. Ludwig Kast, who reported that the case was one of relative hypertrophy of the thyroid, and that removal of the gland would not do any good. In relative hyperthyroidism the thyroid is doing normal work, but the chromaffin group of glands is not doing normal work, consequently the thyroid appears to be acting morbidly, when in fact the chromaffin group is at fault instead.

DR. KAMMERER said that he had recently operated on a young girl for a thyroid enlargement, with marked tachycardia on the least exertion, and slight exophthalmos. The case was evidently one of incipient Graves's disease, somewhat similar to the case presented by Dr. Rogers. He had removed half of the gland and he asked Dr. Rogers if it were possible to distinguish, at this stage, cases of pure hyperthyroidism from such cases as the one he had presented, which developed symptoms of hypothyroidism after removal of part of the gland.

DR. ROGERS said these cases were often very puzzling, and there were no hard and fast rules to act as guides. In cases where the skin was moist, with slight elevation of temperature and a more or less constant tachycardia, the indications were that one had to deal with hyperthyroidism; but with pallor, headache, anæmia, constipation, a dry skin, and a subnormal temperature, the indications were that one had a hypo- rather than a hyperthyroidism, and thyroidectomy was contraindicated. In the case he had shown there was never any constant tachycardia, and the blood-pressure was low; there was only the vasomotor irritability and the nervous excitability with the goitre.

Partial thyroidectomy should have much more restricted indications than seem to be considered necessary. For all cases which show the symptoms usually considered those of hyperthyroidism, the interference should be limited to section of the blood and nerve supply of the thyroid, and both superior and both inferior groups of vessels should be tied before proceeding to the more radical operation. All four of the arteries can be tied without the least ill effect and generally with the greatest benefit.

ADHESIONS OF THE UPPER ABDOMEN.

DR. ROBERT T. MORRIS read a paper with the above title, for which see page 804.

DR. HENRY H. M. LYLE said that at the Congress of French Anatomists a year ago the fact was brought out that in the duodenum there was a normal valve which had often been mistaken for a constriction. It was present in the foetus as a constriction; at five to six years, it was a definite valve with circular muscular fibres. According to Villemain this valve is 1 to 3 cm. proximal to the duodenojejunal angle, shows a definite muscle, and the glands of Brunner stop on the proximal side of the valve. This is the true line of division between the duodenum and jejunum.

DR. GEORGE WOOLSEY said the pathology advanced by Dr. Morris in regard to the occurrence of these adhesions in the abdomen did not appeal to him. He did not understand why the reader of the paper had selected the toxins as the causative factor of such adhesions. These toxins were either foreign proteids or alkaloidal bodies and could not pass through the walls of the hollow version when relatively intact. We knew that bacteria did occasionally pass through these walls and that they would produce adhesions. We did not know that they were caused by toxins, and he thought it would be both simpler and safer to stick to the accepted explanation that they were due to bacterial inflammation.

DR. WINFIELD S. SCHLEY asked Dr. Morris if he had used sterilized olive oil in place of petrolatum to prevent intra-abdominal adhesions. Considerable experimental work had been done in that direction, and the latest theory was that olive oil was preferable to either paraffin or petrolatum. The olive oil should not be boiled but simply sterilized by fractional sterilization, boiling splitting up the fatty acids and making for irritation.

He had used such olive oil in several cases of intestinal obstruction where the obstruction was accompanied with dense and extensive adhesions following peritoneal suppurative conditions, and so far in these cases the results had apparently been good, not only as the general condition of the patient was most excellent but the abdominal as well.

DR. ARPAD G. GERSTER said he thought the statement so often made that the introduction of olive oil or other fatty substances into the abdominal cavity after operation would prevent the formation of adhesions was based on some sort of delusion. It was possible that no adhesions formed after the introduction of such a substance, but that did not prove that their absence was due to the oil. Personally, he believed that the greatest safeguard against the prevention of intra-abdominal adhesions was to leave the peritoneal surface in such condition that no adhesions could form. This depended on a good technic, both operative and especially aseptic, and when one heard of a case where the wound healed without complication and shortly afterward disturbances occurred from adhesions, the suspicion naturally arose that the operation was not an aseptic one. We knew the tremendous tolerance of the peritoneum, and nature's defence in this region against traumatism and infection was the formation of adhesions. If the surgeon did his work in a thoroughly aseptic manner, very few adhesions would result. At Mt. Sinai Hospital, where a large number of cases of appendicitis and other intra-abdominal lesions are seen, many of them septic and in desperate condition, resulting adhesions were comparatively rare, and the speaker said he wished to protest against the rather popular belief that adhesions were a normal consequence of intra-abdominal operations. Slight adhesions that were not due to any severe form of infection would be easily disposed of by the ordinary peristaltic movements of the intestines. Of course, it was known that in cases requiring prolonged drainage, permanent adhesions might follow, but the speaker said he did not believe that in his entire experience he has had to reopen the abdomen more than two or three times on account of obstinate symptoms due to adhesions.

DR. MARTIN said that when the abdomen was opened for the relief of intra-abdominal disturbance and adhesions were found, it was assumed that the adhesions were responsible for the trouble, whereas the pathological condition causing these adhesions might easily be overlooked. He doubted the efficacy of

the introduction of foreign substances in the prevention of adhesion formation, as endothelium, he thought, did not grow in from the sides of the denuded areas like epithelium, but was formed by the modification of mesoblastic cells under the influence of pressure and motion; and that, although their immediate formation might be prevented, they would very readily re-form if any irritative conditions persisted.

DR. ROGERS said that last summer he operated on a patient for the relief of obscure abdominal symptoms, and upon opening the abdomen adhesions were found, which were divided, and the patient's symptoms were apparently relieved. A month later, the abdomen was again opened by another surgeon for a different cause, and adhesions, which were much more numerous than those met with at the previous operation, were found, yet the symptoms calling for the original operation had been relieved.

DR. SCHLEY said the introduction of an oily substance after an intra-abdominal operation permitted of greater mobility of the intestines, and practically the procedure seemed to prove advantageous. In some cases adhesions occurred very rapidly, and it was possible that by the introduction of olive oil or a similar substance, the greater mobility of the parts thus induced might tide the patient over for a sufficiently long time to prevent the occurrence of such adhesions. The use of such substances of course would be chiefly in cases where extensive adhesions had been separated and considerable areas of peritoneal investment were wanting. There was considerable difference in the rapidity and degree to which individuals acted toward peritoneal irritation and formed adhesions, and considerable difference in the degree of resolution or melting away of such adhesions after the cessation of this irritation. If there was anything promising in some of these bad cases it was worth trial, as in a number a chronic peritonitis with new tissue formation followed.

DR. KAMMERER said his experience with oily substances in these cases was very limited. They seemed to him, however, to have a distinct value. On the denuded surface of intestines they acted as a covering, beneath which healing took place, and through which the formation of adhesions with other viscera, at least to a certain extent, prevented mechanically.

DR. LYLE said in regard to the part played by the bacteria in chronic peritonitis and the formation of peritoneal adhesions one

must not forget the rôle played by the anaërobic bacteria. The subject has been very ably handled by Heyde in *Beitrag. zur klin. Chir.*, October, 1911.

DR. MORRIS, in closing, said that in connection with his work on this subject, he had carried out a number of experiments on rabbits and dogs, and he had found that after an intra-abdominal operation adhesions were more or less apt to occur, no matter what precautionary measures were used, and that they could be lessened by any method which would permit new endothelium to cover the denuded surfaces.

In regard to the choice of an oily substance to prevent the occurrence of intra-abdominal adhesions, Dr. Morris said it seemed to him that the animal oils were absorbed more rapidly than any other; the vegetable oils came next in order, while the mineral oils, particularly those of the paraffin group, were taken up much less rapidly, and for that reason he had come to depend largely on mineral oils of the heavier type, which were absorbed very slowly and would keep the visceral surfaces apart during the interim when plastic lymph would be most apt to lead to adhesions. By thus introducing a mechanical obstacle to the formation of adhesions, time was afforded for new endothelium to cover the defect.

Dr. Morris said he was surprised to hear Dr. Gerster's remarks on the subject of adhesions in general. If he admitted that the Lane kink was productive of symptoms, as most of us believed, then we might assume that still more extensive adhesions in other parts of the peritoneal cavity would lead to greater trouble. The speaker said he had seen many cases of supposed gall-stones where as a matter of fact the symptoms were due to the presence of adhesions. The severity of the symptoms depended not so much on the extensiveness of the adhesions as upon their particular location.

Dr. Morris said he was interested in Dr. Lyle's statement that these upper abdominal adhesions had been attributed to the presence of anaërobic bacteria, and that he would be pleased to make further investigations along that line. The influence of anaërobes furnishes a new and promising field for study.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held March 4, 1912.

The President, DR. GWILYM G. DAVIS, in the Chair.

GENERAL INFECTION FOLLOWING ACUTE TONSILLITIS.

DR. WILLIAM J. TAYLOR read a paper with the above title, for which see page 785.

DR. JOHN H. JOPSON reported the case of a boy of 18 who during the past winter had been the subject of repeated attacks of acute tonsillitis, two or more of these attacks being succeeded by attacks of pyelitis or, as his physician, Dr. Geisler, diagnosed them, ureteritis. The connection between the two conditions was apparently very definite, and the kidney condition was exceedingly acute and disabling. Finally his tonsils, which were badly infected, were removed by Dr. Stout, and since then he has remained well.

DR. WALTER G. ELMER recalled a case which came under his own care. This was a lady 73 years of age in which the infection travelled from her throat through the Eustachian tube to the middle ear, her temperature reaching 105.5°. This was followed the next day by diffuse abdominal tenderness, marked distention, and marked tenderness over the appendix, so that in a younger subject a diagnosis of acute appendicitis would have been made and operation advised. She being 73, and the fact that the ear was relieved by drainage and the symptoms subsiding, of course operation was not considered. This case, however, shows the similar relationship between throat infection and the abdominal cavity of which Dr. Taylor spoke.

DR. CHARLES F. NASSAU said that some four weeks after a total hysterectomy, the patient being perfectly well and at her home, she developed an acute tonsillitis. This was treated by a physician who evidently cleaned out some tonsillar crypts. The

patient said it had caused her great pain. About 48 hours after that she developed a thrombophlebitis of the right femoral vein and since then she has had a periurethral abscess. At no time was there any trouble with the hysterectomy wound, although that is necessarily under suspicion; but she had been so well prior to her tonsillitis that he could not think her later trouble had anything whatever to do with her abdominal operation, but was a spread of infection from the tonsils.

DR. JOHN B. ROBERTS said that he wished that Dr. Taylor's paper could be read by all laryngologists, who are so earnest and anxious to radically remove the tonsils of many children, between five and fifteen years of age. Dr. Taylor says that it was suggested, at the meeting in Budapest, that the tonsils be taken out in cases of acute rheumatism, because of the connection between tonsillar infections and this infection of the joints. His own feeling had been that nature puts the faucial tonsils, the pharyngeal tonsil, and the lingual tonsil at the opening of the gastro-intestinal canal as a protection against general infections. When infection gets into our mouths the tonsils probably act as a filter plant, in a manner similar to the action of the inguinal and axillary glands, which catch the micro-organisms which come from the lower and upper extremities respectively. Therefore it is a very unwise thing to take out radically either moderately diseased or occasionally diseased tonsils of a child until we have more authoritative knowledge of the functions of these juvenile organs. These cases of Dr. Taylor's show apparently that the first place the infection stopped was at the tonsil. Of course if the infection gets beyond the tonsils, either because the tonsils have been removed or because their filter function is not in good working order, general infection occurs and may show arthritic, abdominal, or other symptoms.

DR. ROBERTS related a case in which the tonsils and adenoids in the pharynx were extirpated for a young child, in whom it had been advised that the pharyngeal adenoid tissue be removed, because of earache. To his surprise the operator also removed the slightly enlarged tonsils. A few months later the child died of a very acute cerebrospinal infection, proved by autopsy and monkey inoculation. It is asserted that that disease, the so-called anterior poliomyelitis, comes usually through infection of the pharynx. Does it not seem possible that the acuteness and severity of the general infection in that particular patient were greater because

one of the safeguards of the system, the tonsils, had been removed a few weeks prior to the time the bacterial cause of the disease happened to reach the mucous membrane of the child's throat?

DR. DAMON B. PFEIFFER related the history of a medical student who had fractured the external malleolus of the right fibula. While in the hospital he had a severe attack of tonsillitis, bilateral; he previously had had tonsillitis many times when a child, and claimed that the tonsils had been removed by cauterization, but there evidently was some submerged tissue which was not removed. He was given the ordinary treatment, in spite of which a tonsillar abscess formed, which was incised and considerable pus evacuated. He left the hospital in a few days and went home to recuperate. A few days later he noticed blood in the urine, which, upon standing, was sufficient to form a clot in the sedimented portion and he is now suffering from a very severe hemorrhagic nephritis.

THE RADICAL CURE OF HERNIA.

DR. CHARLES F. NASSAU read a paper with the above title, for which see page 857.

DR. RICHARD H. HARTE said that there is one important feature that is often overlooked in the question of operation for hernia, and that is the importance of having the wound thoroughly dried before closing. This is often responsible for the failure to get absolutely clean, healthy wounds. He firmly believed that this is the reason why so many men whose technic cannot be questioned get suppuration, from hemorrhage setting in after the reaction of the patient.

DR. JOHN H. JOPSON could not agree with Dr. Nassau as to what he says of the lack of value of the rectus transplantation by the Wölfler method. He had nearly always incised the anterior covering of the rectus muscle when transplanting it, which he has done many times, in hernias, where the conjoined tendon was poorly developed, and he included in his stitches the conjoined tendon, and if the incision in the sheath is made of a fair length, one can bring the rectus muscle down to the desired point on Poupart's ligament without undue tension.

DR. WILLIAM L. RODMAN believed that transplantation of the anterior sheath of the rectus is one of the most important steps that has been made in operations for hernia. It seemed to him that the transplantation of the sheath itself is more

important than the fibres of the muscle, because the latter would atrophy soon after transplantation and be of no real resistance to the future descent of a hernia. Another very important point is whether or not the cord shall be transplanted in the average case. Formerly he believed that the technic of Bassini was much the best, and he was prepared to believe so yet in a majority of cases; still he did not feel at the present time that it was absolutely necessary to transplant the cord in every case. Certainly it is a distinct disadvantage in some; as, for instance, if we have associated an undescended testis where the cord is already too short. It also seems an unnecessary step in the average case, in children, because almost any operation in them will be followed by cure. He had been omitting this step increasingly in the last five years, and although it was impossible for him to say that all these cases had done as well as where the cord was transplanted, as he had not reviewed them, yet that was his impression. Transplantation is necessary in direct hernia particularly, but in oblique hernias it may be an unnecessary step.

Most important in hernia operations is the choice of suture materials. Bassini used silk in his operations, and many others also until a number of fistulæ or sinuses caused them to abandon silk. He formerly used silk a great deal because he had not sufficient confidence in catgut or kangaroo tendon; but for the last 10 or 15 years he had very generally preferred the absorbable suture, and the best is small kangaroo tendon. Kangaroo sutures as generally used are much larger than is necessary and the knots have been the cause of trouble in the majority of instances; to this he attributed his late infections years ago. Small kangaroo tendon can be as completely sterilized as anything else and is sufficiently abiding. A suture should abide for three or four weeks to insure safety. The use of rubber gloves also has done more to make the results in hernias good than anything else except the absorbable suture materials. The use of gauze dissection is not disadvantageous if done carefully.

As to the use of cocaine, while it is undoubtedly a valuable advance, yet it is for the exceptional rather than the ordinary case. Where there are distinct contraindications to ether, cocaine should be used exactly in the way Dr. Nassau has shown. He had witnessed failures in the hands of those most familiar with cocaine.

DR. CHARLES F. NASSAU, in closing, remarked that he had

stated that Bloodgood in his transplantation utilizes the outer border of the rectus muscle behind the internal oblique and in front of the peritoneum. Dr. Halsted has in certain isolated cases utilized the whole sheath to cover the defect, but in the Wölfler method it is pulled out through the anterior sheath, and in Bloodgood's method the retractor is introduced beneath the internal oblique and transversalis and by pushing back the bladder the incision is made (along the outer border of the rectus), and the whole strength of the anterior sheath is then left to cover over and it may even spread out after the edge of it is freed. These are the advantages and differences between Wölfler's and Bloodgood's transplantations, it being the transplantation of the rectus muscle, not of the sheath, in any sense whatever, in every method.

He did not go into the question of suture material as he considered it unimportant. His own preference is for silk when the work is being done where he knew the silk stays in. In the Frankford Hospital where he had control of the technic and had had the same operating room nurse for years, he used silk almost exclusively as a buried suture until the last three years, when he had been using catgut, although also using silk in selected cases. He had taken out but one silk stitch from an inguinal hernia; he had taken out two buried silk sutures in seven years, and both of these he put in himself, the second time being in an epigastric hernia. Chromicized catgut, if the best brand is used, is all right.

In the question of operation under local anæsthesia, if the patient squirms over the table, suffers pain, and the surgeon is worried and things are prolonged, then it is better not to operate in this manner. On the other hand, if the surgeon does not make a reasonably persistent effort to master that technic in a certain number of cases, when the time comes where he needs it he cannot do it except his patient suffers pain, and he therefore does an incomplete operation. In one patient of 75, the only one of the series in which he resected nine inches of bowel, this was done painlessly and the old man got well. Through the courtesy of Dr. DaCosta he had two men patients in the wards at the Jefferson Hospital at the present time, both of whom went through their operations well, and he would be very glad to have any who are interested go in and see them. They lay on the operating table in perfect comfort with the exception of slight

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FIG. 1.



Enlargement of superficial veins consequent upon occlusion of the vena cava inferior.

sensations at one or two spots where they warned him he was impinging on tender ground. The thing can be perfectly accomplished if one gives a little time to it.

TWO CASES OF CAVAL OCCLUSION: (1) VENA CAVA INFERIOR; (2) VENA CAVA SUPERIOR.

DR. PENN G. SKILLERN, JR., described these cases with remarks.

CASE I.—A man, 20 years of age, in April, 1910, contracted enteric fever, for which he was treated in the Pennsylvania Hospital for three months. During the third month of the disease he noticed that both legs were slightly flexed, painful, tender, and beginning to swell. They have remained swollen since. Pain started in feet and extended upward to pelvis, and also to the right lumbar region, which latter was but temporary. About two months after discharge from the hospital he noticed for the first time enlargement of the superficial veins, first in the left inguinal region, from whence the veins "began coming out all over"; he did not notice the time or order of appearance of the veins after this. These veins have not decreased in size until one week previous to this report (Feb. 26, 1912), when he noticed for the first time that they were undoubtedly diminishing in size. He feels well in other respects: no gastro-intestinal disturbances, not even piles.

Examination reveals an ulcer over each shin, in the course of the internal saphena, both 2 cm. in diameter and both presenting the usual characteristics of varicose ulcer. Moderate œdema of legs and feet.

After elevation of the lower extremities against the wall for 15 minutes, to gravitate as much of the fluid as possible from the limbs, each limb was encased in an Unna's paste dressing from the roots of the toes to the tibial tubercles.

Examination also revealed the condition of the superficial veins shown in the accompanying photograph (Fig. 1).

Along the course of both saphena there were dilated venules, taking for their pattern the delicate tracery of fine seaweed. The course of dilated and tortuous veins on the respective sides was noted as follows:

Right side. Thigh: Superficial circumflex iliac between saphenous opening and anterior superior iliac spine, just below

which it was markedly tortuous and enlarged. Abdomen: A dilated and tortuous vein receives the column of blood from the superficial external circumflex iliac and conveys it to the right axilla, passing lateral to the nipple. The superficial epigastric runs upward near the outer border of the rectus to inosculate with the superior epigastric. The superficial external pudic joins with its fellow. Chest: Anterior perforating cutaneous branches of internal mammary are more prominent below than above the nipple.

Left side: Thigh: Vascular mass over the saphenous opening, representing ampulla of saphena, and simulating femoral hernia. At the middle of Poupart's ligament there is the greatest dilation, the vessel here being 2 cm. in diameter as measured by the calipers. Abdomen: Superficial epigastric takes a prominent part. It sends a branch toward the navel which suggests the *coeliotomy vein* of Kelly, and which divides at the level of the navel, one branch inosculating with the superior epigastric, while the other makes almost a bee-line for the nipple, just short of which it disappears. Most of the current of the superficial epigastric, however, is diverted through a large tortuous vessel, which courses obliquely upward and outward to the middle of the axilla, and which corresponds to the *vena thoracica epigastrica longa tegumentosa* of Braune.

No noteworthy dilation immediately about navel. No piles. No varicocele. Area of hepatic and splenic dulness not increased. Examination of heart and lungs negative. Superficial cervical veins not enlarged.

The patient cherished an ambition to enter the service, so that the possibility of subsidence of the veins was pointed out to him. In the meantime he was advised to wear a leathern girdle with pelvic straps to support the vessels as well as to protect them from injury, and under no circumstances to permit excision of the veins.

Dr. Skillern recalled the statement of Osler that "There is no more interesting subject of study than the way in which channels of collateral circulation are established in occlusion of large vessels." As a corollary to this, he thought an equally interesting subject of study was to diagnose the character and location of the occlusion as indicated by the topography of the enlarged veins. In this case it is clear that we have to deal with a pre-

viously occluding but now canalized thrombus situate at the beginning of the vena cava inferior just above its great iliac tributaries. It could not be in one of the iliac veins, as in the case depicted by Ashhurst (*Jour. A. M. A.*, 1907, xlviii, 1840), and in that by Davis (*Applied Anatomy*, 1910, 380), because of the bilateral involvement. There might be a thrombus in each common iliac, but this is very improbable, and is not in accord with the history of *simultaneous* swelling of both lower extremities. For the same reason the thrombus did not start in one iliac vein (or tributary) and propagate itself to the cava, or into the other common iliac. The history states that enlarged veins were first seen in the left groin, whence they spread in various directions. We can still reconcile this with the pathology, for until the veins on the left side began to enlarge the cava was not yet completely occluded, but the thrombus propagated itself retrograde to the current and occluded the left common iliac first and later the right. There is present, then, a T-shaped thrombus.

Nor was the thrombus as high as the diaphragm, as in the case reported by Osler (*Jour. of Anat. and Physiol.*, 1879, xiii, 291), in which there was great stenosis of orifices of hepatic veins, for this patient exhibited no signs of portal obstruction, to wit: enlargement of liver and of spleen, gastro-intestinal catarrh, and piles. Nor was it as high as the renal, owing to the absence of albuminuria, nor even as the spermatic, since there was no evidence of right-sided varicocele.

Direction of circulation was from below upward.

Welch in 1909 (*Allbutt and Rolleston, System of Medicine*, 1909, 751) states that there are reports of at least 140 cases of this affection, so that it is relatively rare. In addition to the superficial veins returning the diverted blood, there is also doubtless a deep collateral circulation by way of the subperitoneal plexus described by Sir William Turner, as well as by dilated venæ azygos minor et major. Were the burden of returning the blood borne wholly by the deep veins, diagnosis would be rendered difficult on account of the negative results of inspection.

CASE II.—Clinical Summary: Aneurism of aortic and popliteal arteries; compression of vena cava superior; extensive extracaval collateral circulation. Male, aged 46. No history could be elicited that bore any causal relationship to his vascular disease.

In July, 1907, he sought surgical advice for aneurism of the

right popliteal artery, and underwent the operation of ligation of the superficial femoral artery at the apex of Scarpa's triangle, right side.

In 1903, four years previous to this operation, he noticed the superficial abdominal veins beginning to enlarge. These veins shortly reached their present size, and have neither increased nor diminished in calibre.

Examination reveals a tall, fairly well-developed man, whose appearance is indicative of good health. Impact of heart against chest-wall greater than normal. Râles scattered throughout lungs. Liver enlarged, particularly in epigastrium. Area of splenic dulness increased. Hemorrhoids present. No inequality of pupils or of radial pulses noted; voice clear and resonant. No brassy, unproductive cough.

Regarding the dilated and tortuous superficial veins, these were noted as follows:

Lower extremities: No varicose veins, no varicose ulcers, not even legacies of these lesions nor scars about knees were observed.

Right side: Abdomen: Superficial epigastric ascends to 1 cm. below navel and deviates to the right to cross the level of the navel 3 cm. laterally. It then inosculates with the superior epigastric, which fuses with its fellow over the ensiform. Chest: A dilated vein runs from the middle of the axilla to the fifth intercostal space, where it disappears. Neck: Dilation of superficial veins, particularly about root of neck.

Left side: Abdomen: Superficial epigastric, smaller than its fellow, crosses level of navel 6 cm. from mid-line. In this portion of its course it loops over to join its fellow across pubic hair 3 cm. above root of penis and again just below navel. It then inosculates with the superior epigastric, which fuses with its fellow over the ensiform. From the ensiform a single vein courses upward in front of the sternum to join both external jugular veins. This single vein receives as tributaries the anterior perforating cutaneous branches of both internal mammary veins. As on the right side, a dilated vein runs from the middle of the axilla to the fifth intercostal space, where it disappears. Neck: Dilation of superficial veins, particularly about root of neck.

Remarks.—Unfortunately this patient became sensitive to a degree in regard to his condition, and it was only out of courtesy to Dr. Miller that he submitted to examination, which was rather hastily conducted in a dressing-room of the clothing shop. He

would not consent to be photographed, to have blood taken for a Wassermann test, nor to appear before a medical society. There is no doubt, however, that the site of the venous occlusion is the vena cava superior; this is attested by signs of portal obstruction, namely, enlarged liver, enlarged spleen, and presence of piles; by the venous dilation about the root of the neck; and by the great similarity of the collateral venous circulation to previously reported cases, particularly that of Osler (*Johns Hop. Hosp. Bull.*, 1903, xiv, 171), the photograph of whose patient shows a collateral venous circulation which is almost the exact counterpart of those in this patient. That the compression of the cava is aneurismal in cause seems justified by the presence of arterial degeneration as shown by the existence of the popliteal aneurism, and by the chronic cough, backache, and intercostal neuralgia from which he suffers. That the cause of the cardiovascular disease is obscure is admitted, but the probability of its luetic nature is suggested in the history. Whether the man's occupation as a salesman of clothing for 20 years up to the time the disease first appeared, during which time he was on his feet all day and constantly lifting more or less heavy wearing apparel, had any causal relationship with his vascular disease, is problematical. It is noteworthy that he attributed his trouble to worry, which may or may not have been a cloak to conceal the real origin of the malady.

Welch (*loc. cit.*, p. 755) in 1909 found records of 35 instances of obliteration of the superior vena cava. He states that one-third of the cases are due to thrombosis, but that most depend either upon pressure from without, as by aneurisms, or upon syphilis. Dilation of superficial veins is especially marked over the anterior wall of the thorax and upper part of the abdomen, as held in Dr. Skillern's case. After reviewing a train of head and arm symptoms and signs that might be produced by venous obstruction near the superior thoracic aperture, he says: "In the light of the whimsicalities of venous thrombosis, it is hardly necessary to add that the symptoms may be less marked, and may deviate from what might naturally be expected."

The essential differences between these two cases are, first, the direction of the current. In Case I, where the inferior cava was obstructed, the blood was conducted efferent from the femoral veins afferent into the axillary veins, so far at least as the superficial circulation is concerned. The direction of the current was

from below upward. In Case II, on the contrary, where the superior cava was blocked, the blood was conducted efferent from the innominate and axillary veins afferent into the femoral veins. The direction of the current was from above downward. Then in Case I the veins of the lower extremities were involved, and there were varicose ulcers, while in Case II these vessels were uninvolved, probably because compensation by way of the deep abdominal veins was sufficient to obviate too much positive pressure upon the saphena veins, while the femorals below the latter took care of themselves by means of their powerful valves. In Case I there was no portal obstruction, while in Case II this was marked. In Case I there were no dilated veins over the sternum or at the root of the neck, while such was the feature of Case II. In Case I the etiology was unmistakable, while in Case II it was most likely luetic. Finally, the difference in ages. The first patient was 20 years of age, far below the period of vascular decadence, while the second patient was 37 when his malady started—well within the period of vascular degeneration.

FRAGMENT OF FILIFORM BOUGIE NUCLEUS OF VESICAL
CALCULUS.

DR. HENRY R. WHARTON related the history of a man, 30 years of age, who was admitted to the Presbyterian Hospital June 15, 1911, on account of retention of urine due to a close stricture of the membranous portion of the urethra; notwithstanding adequate dilatation of the stricture he continued to suffer from intermittent attacks of retention. Upon exploration of the bladder by a searcher a stone was felt. Median perineal apotomy was then done, and two calculi were removed, each of which had developed upon either end of a four inch long fragment of a filiform bougie. Upon inquiry it developed that the man had been treated for his stricture one year before at another hospital, and it was presumable that in the course of this treatment the fragment of bougie had been left in the bladder. The mechanism of the intermittent retention may be explained by the fact that at times one of the stones attached to the fragment of bougie was forced into the urethra during micturition and for the time occluded it.

DR. MORRIS BOOTH MILLER said that some three or four years ago he had almost an identical experience. While on duty

at the Philadelphia General Hospital he had a patient under his care with a persistent perineal fistula following an external urethrotomy. Nothing that he could do would close the fistula, so finally under ether he explored and found an incrustated filiform which had been cut off. The larger portion of it was in the bladder but a portion was in the urethra. Upon consulting the colleague under whose care the patient had previously been, he recollected that he had introduced two filiforms and thought they had both come out intact, but what had happened was that one had been cut off in the operation and a piece about three inches long had been allowed to remain in the bladder.

DR. THOMAS C. STELLWAGEN said that he had in four or five instances detected in the bladder with the cystoscope portions of a filiform bougie. The Gouley catheter is dangerous, for after long use the tip gets sharpened and cuts the end of the filiform, and the surgeon does not realize it.

Each filiform should be most carefully tested through the Gouley or set of Gouleys before using it, because the filiforms sometimes do not allow the Gouley to slide freely over them, and too much force may be used, and in this manner the end is forced into the bladder and cut off.

DR. A. P. C. ASHHURST said that it used to be taught by the late Prof. John H. Brinton that when the Gouley catheter has been passed down to the stricture over the filiform, it was safer to push both the filiform and Gouley catheter together, passing them both at the same time from this point on; because if one pushed the catheter onward over the filiform one surely would cut the end off the latter.

DR. G. G. DAVIS said that some filiforms are made of whalebone, some of the French of silk, others of hardened catgut or silkworm gut; the whalebone ones are quite brittle and they not infrequently break, while the French ones are more apt to double on themselves.

CORRESPONDENCE

GAUZE LOST IN A BONE CAVITY FOR FIFTEEN MONTHS.

EDITOR ANNALS OF SURGERY:

Gauze has been reported as left behind in many parts of the human anatomy, and has required removal later for irritation symptoms. Complete encapsulation of a gauze sponge left in a bone cavity is, I believe, unique and justifies the reporting of the following case:

Mrs. P., aged 55, Scandinavian, came into my service at the University Hospital in January, 1910, with the following history: In the spring of 1908 she fell and bruised her left leg, after which it pained her and caused some disability. There was no swelling and no skin injury. The later history is rather indefinite, but the pains continued and became worse, and in the fall of 1909 she was operated upon, the left tibia being opened and some bone removed. She obtained slight relief from the pain after this but it soon returned, and the operation wound never completely healed.

Examination showed the tibia enlarged in its lower third with a scar along its crest for six inches, and two sinuses running down to bare bone. Below the site of this old operation reaching almost to the ankle was a marked enlargement of the tibia, which was painful to point pressure, and gave the impression of œdema in the overlying periosteum. Temperature was 100.2°, pulse, 85; leucocytes, 4500. A diagnosis of abscess of the lower end of the tibia was made, and the patient was operated upon by the writer.

The old wound was first explored and the sinuses were found to be superficial and due to incomplete healing of the bone cavity. The bone was chiselled away and all unhealthy tissue removed. No communication with the lower lesion was found, so the front of the tibia was chiselled away over the swollen area, opening a large encapsulated abscess shut off from the old field of operation by a wall of dense bone. In this abscess cavity was found a folded piece of gauze about eight inches square. The two cavities

were merged, made aseptic, and filled with the Moorhof bone plug, and the woman made a good recovery.

By corresponding with the first operator it was learned that he cut a long trench in the tibia and filled same with the Moorhof bone wax. There was much bleeding and the bone wound was packed with gauze sponges to check it, and one of these sponges was evidently left behind in the extreme lower part of the bone cavity, and being covered by wax became entirely encapsulated.

It is quite a tribute to the Moorhof technic that such a result could be obtained and that the gauze remained *in situ* for 15 months, though the regular irritative result of the presence of gauze was finally manifested, resulting in abscess, which would probably without operation have perforated the anterior shell of bone at some distance from the scar of the old operation.

This case is, I think, unique, and only possible with the use of the Moorhof technic.

J. CLARK STEWART, M.D.,
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CHRONIC OXYURIS INFECTION WITHOUT APPENDICEAL SYMPTOMS CURED BY APPENDECTOMY.

EDITOR ANNALS OF SURGERY:

The following case was seen at the Presbyterian Hospital in the surgical service of Dr. J. A. Blake, to whom the writer is indebted for the privilege of operating upon and reporting the patient. The case seems of interest, for in a rather extended search through the literature we have been unable to find a single report in which appendectomy has been done, not for symptoms of appendicitis but solely to determine its effect upon an intestinal infection with *Oxyuris vermicularis*. Many cases of appendicitis in which the appendix contained pin-worms have been reported, but the especial interest in this case lies in the fact that the patient has never had a symptom referable to the appendix.

M. L., age 54 years, married, female; was admitted to the Presbyterian Hospital on January 8, 1911, complaining of bearing down pain and a mass in the abdomen. These symptoms had been present for about eight years and were due (as was shown at

operation) to a large fibroid uterus weighing 14 pounds. She had also been troubled for about 20 years by pin-worms, which she had frequently noticed and which caused severe anal and perineal itching. During these 20 years she had from time to time made determined efforts to be cured of the worms, being treated at various dispensaries and by several private physicians. Most if not all of the medical means had been tried, including diet, cathartics, intestinal antiseptics, anthelmintics, and rectal medication. Examination of the stools of this patient before operation showed oxyuris and their eggs.

Under general anaesthesia a supravaginal hysterectomy was done by Dr. Blake, followed by an appendectomy by the writer. The patient made a smooth convalescence and was discharged, cured, January 28, 1911.

The appendix measured 8 cm. in length. Serosa was smooth, pale, and glistening. On opening the appendix it was found to contain soft brown faeces and six oxyrides, three of each sex. Over 450 microscopic sections of this appendix were prepared and examined, but no changes other than some swelling of the lymph follicles and a moderate infiltration of eosinophiles in the mucosa could be found.

The case has now been followed for a little over 14 months and has remained well in every way. She has complained from time to time of some anal itching, but this has not been severe and seems to be due to a slight eczema in this region. She has noticed no more pin-worms, and repeated examination of her stools have failed to show either oxyuris or their eggs.

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WITH THE COLLABORATION OF

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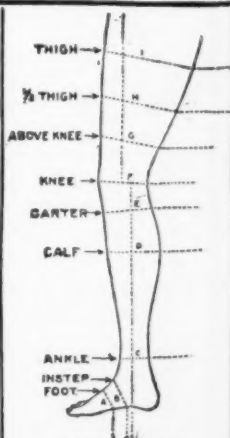
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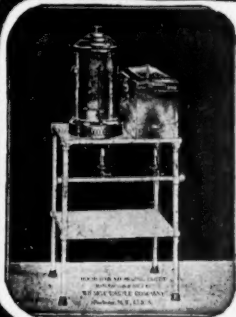


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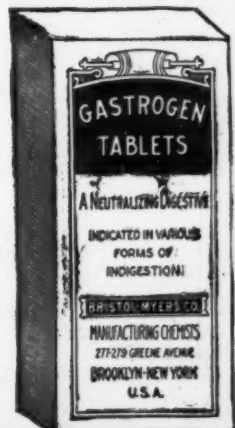
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But don't stop there! We want you to find out now, once for all, whether this hypodermic tablet of hyoscine, morphine and cactin is what we claim or is not what we claim. Prove for yourself what we say about this agent—or disprove it—apart from anything you have previously read or heard.

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H-M-C is a safer anesthetic than chloroform or ether, and more satisfactory in every way.

H-M-C is a better pain-reliever than morphine.

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